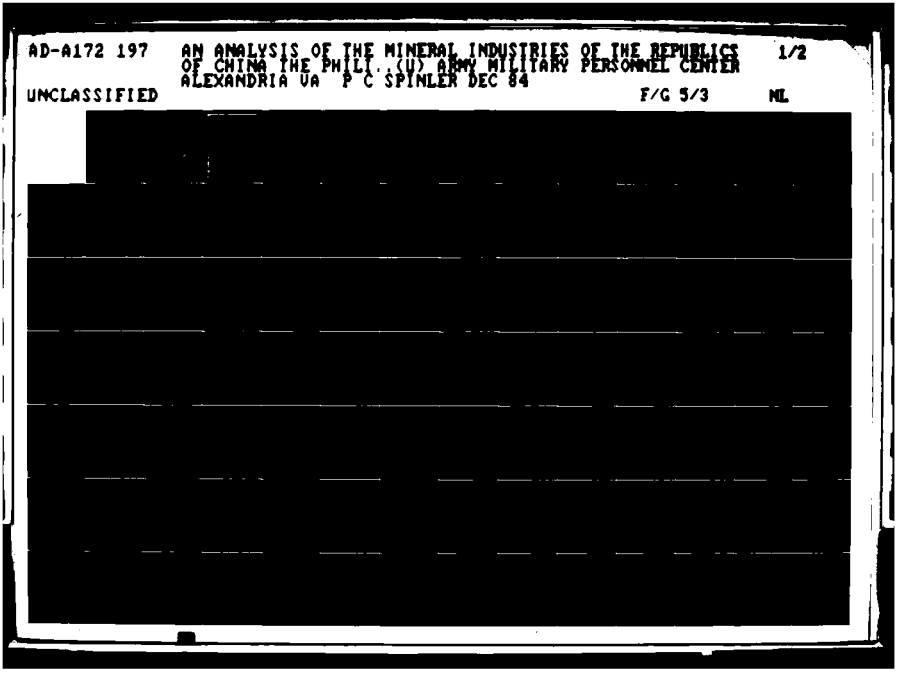
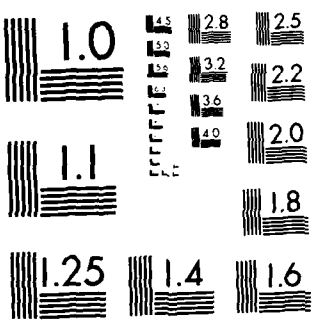
AD-A172 197 AN ANALYSIS OF THE MINERAL INDUSTRIES OF THE REPUBLICS OF CHINA THE PHILI..(U) ARMY MILITARY PERSONNEL CENTER ALEXANDRIA VA P C SPINLER DEC 84 1/2

UNCLASSIFIED F/G 5/3 NL





UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

AD-A172 197

## REPORT DOCUMENTATION PAGE

READ INSTRUCTIONS BEFORE COMPLETING FORM

| 1. REPORT NUMBER | 2. GOVT ACCESSION NO. | 3. RECIPIENT'S CATALOG NUMBER |
|---|---|---|
| | | |

4. TITLE (and Subtitle)
An Analysis of the Mineral Industries of the Republics of China, the Philippines, and Korea, the Kingdom of Thailand, and New Zealand Vol II Chapters 5-7

5. TYPE OF REPORT & PERIOD COVERED
Masters Thesis
December 1984

6. PERFORMING ORG. REPORT NUMBER

7. AUTHOR(s)
Captain Paul Charles Spinler

8. CONTRACT OR GRANT NUMBER(s)

9. PERFORMING ORGANIZATION NAME AND ADDRESS
Student, HQDA, MILPERCEN (DAPC-OPA-E),
200 Stovall Street
Alexandria, Virginia 22332

10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS

11. CONTROLLING OFFICE NAME AND ADDRESS
HQDA, MILPERCEN, ATTN: DAPC-OPA-E,
200 Stovall Street
Alexandria, Virginia 22332

12. REPORT DATE
December 1984

13. NUMBER OF PAGES
343 TOTAL COUNT

14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office)

15. SECURITY CLASS. (of this report)
UNCLASSIFIED

15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)
Approved for public release; distribution unlimited.

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

SEP 1 9 1986
A

18. SUPPLEMENTARY NOTES
THESIS
Energy and Minerals Resources Program
University of Texas at Austin

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)
Minerals, Minerals industry, Metals, Energy minerals, Industry, Republic of China, Taiwan, Republic of the Philippines, Republic of Korea, South Korea, Kingdom of Thailand, Siam, New Zealand, Western Pacific countries

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)
Taiwan's mineral wealth is very meager in world terms, limited in development because of the country's non-membership in world lending organizations. The Philippines has an extensive natural resource base of many strategically important minerals, but the country is extremely indebted, lacking capital to develop infrastructure and processing capacity. The Republic of Korea has not completed mineral potential surveys of the entire country. The

DD FORM 1 JAN 73 1473 EDITION OF 1 NOV 65 IS OBSOLETE

UNCLASSIFIED
SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

DTIC FILE COPY

86 9 18 029

Block # 20 (continued):

country's rugged terrain and undeveloped infrastructure is largely blamed for incomplete geological surveys. Thailand has significant mineral resources, but the government has no minerals policy and cannot control widespread minerals smuggling and illegal mining. This situation discourages large mineral ventures. New Zealand is also a dwarf with respect to its mineral wealth. This country has depended very heavily on farm products and is in the process of diversifying its economy. Important minerals in this part of the world include chromium, copper, cobalt, gold, tin, tantalum, natural gas, antimony, graphite, tungsten, and talc.

# AN ANALYSIS OF THE MINERAL INDUSTRIES OF THE REPUBLICS OF CHINA, THE PHILIPPINES, AND KOREA, THE KINGDOM OF THAILAND, AND NEW ZEALAND

Paul C. Spinler, Captain
HQDA, MILPERCEN (DAPC-OPA-E)
200 Stovall Street
Alexandria, Virginia 22332

MASTER OF ARTS THESIS
December 1984

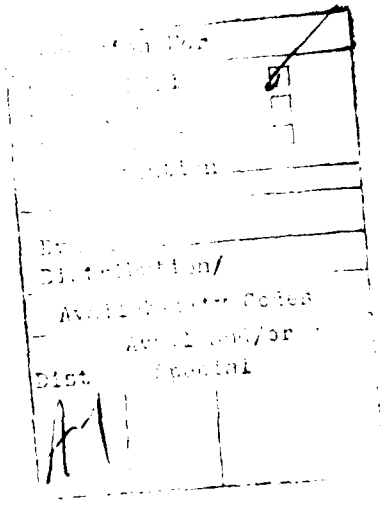


Submitted to
The University of Texas at Austin
Austin, Texas
in Partial Fulfillment
of the Requirements
for the degree of
MASTER OF ARTS

# AN ANALYSIS OF THE MINERAL INDUSTRIES OF THE REPUBLICS OF CHINA, THE PHILIPPINES, AND KOREA, THE KINGDOM OF THAILAND, AND NEW ZEALAND.

VOLUME II.

CHAPTERS 5-7.



# CHAPTER FIVE:

# THE

# MINERAL INDUSTRY

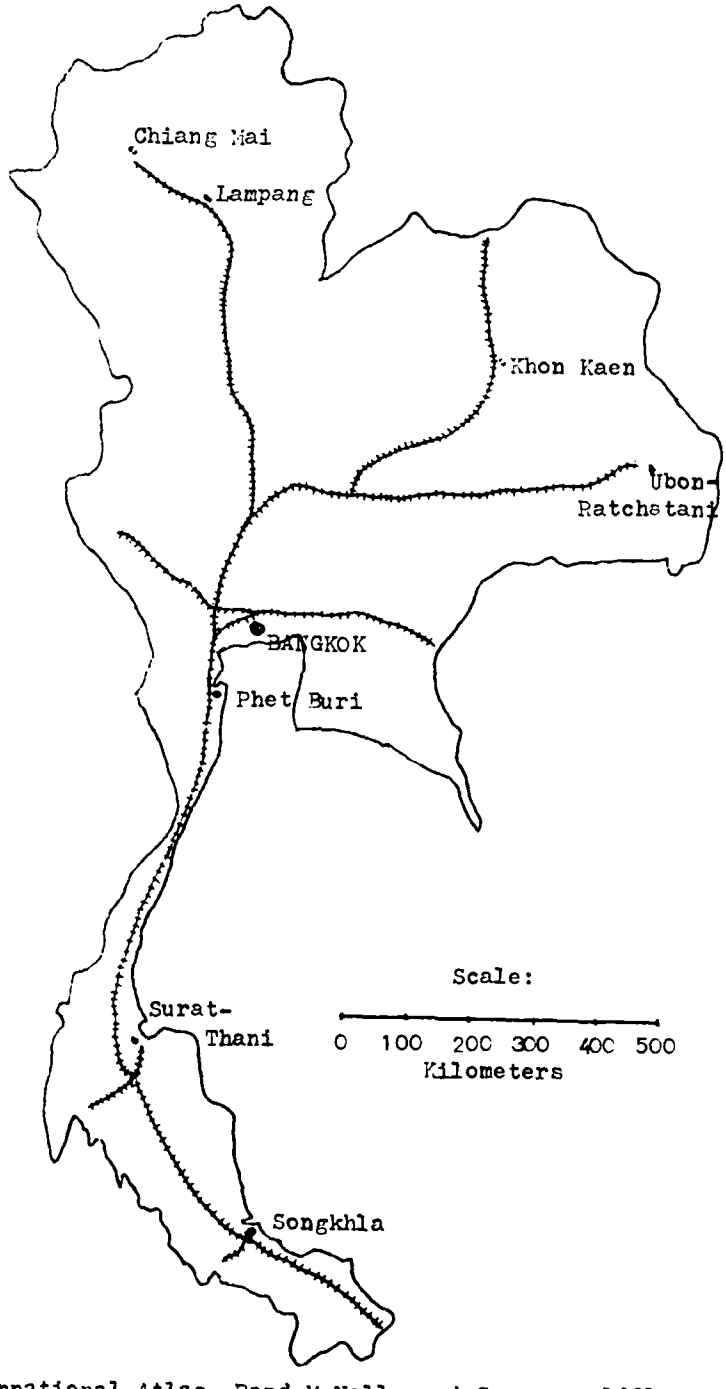
# OF

# THE

# KINGDOM OF THAILAND

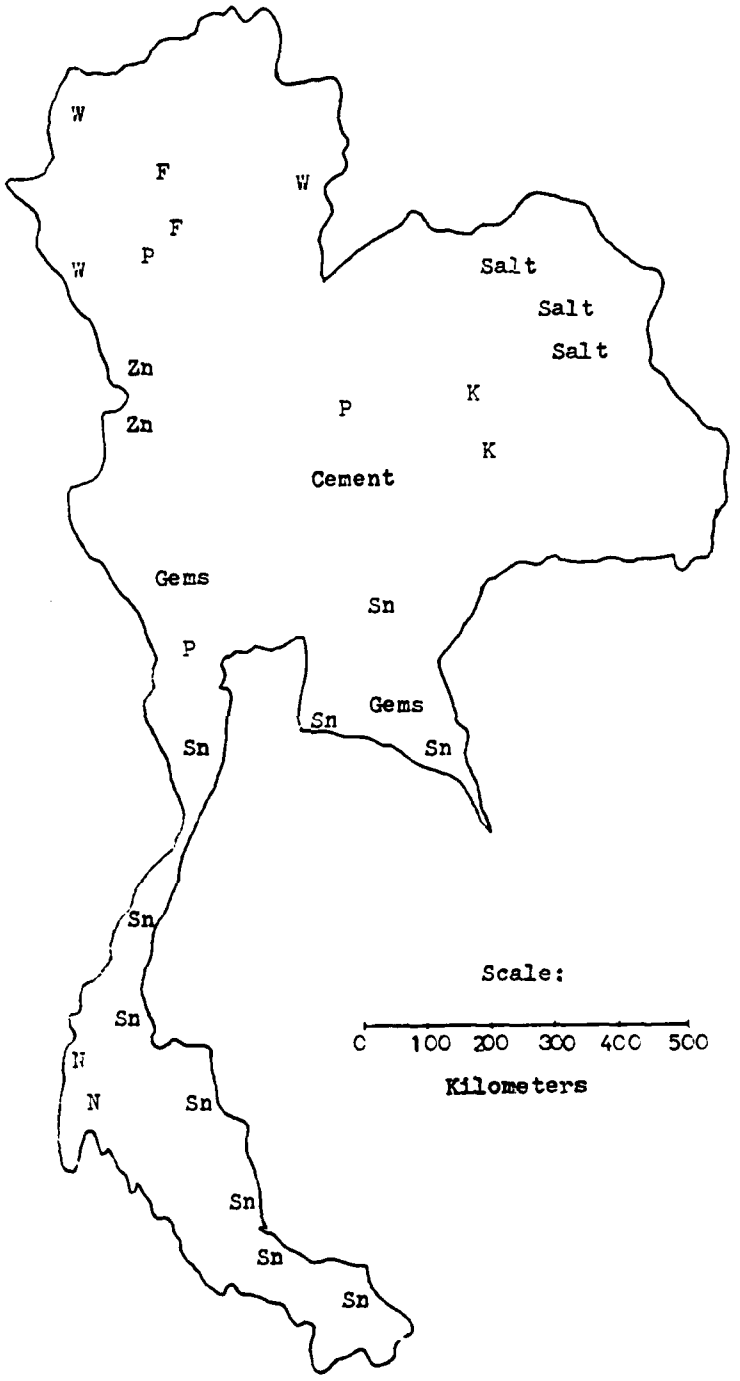
# (SIAM)

Map 5-1. Geographic Map of the Kingdom of Thailand




Source: The International Atlas, Rand McNally and Compnay, 1981.

Map 5-2. Mineral Distribution in the Kingdom of Thailand




Source: The International Atlas, Rand McNally and Company, 1981.
Thailand: A Country Study, Washington, D. C., 1981.

## INTRODUCTION

The Kingdom of Thailand, formerly known as Siam, is situated in Southeast Asia and extends far south down the narrow Kra Peninsula to Malaya (Peninsular Malaysia). It is bordered to the west and north by Burma, to the northeast by Laos, and to the southeast by Kampuchea (Cambodia). Thailand has an area of approximately 209,411 square miles and a poulation, in 1982, of 48,490,000 people.[1] Bangkok, the nation's capital, is the largest city with a population of 4.9 million inhabitants.[2]

Thailand's geography is varied, being dominated in the central plain by the Mae Nam Chao Phraya River system. The northeast is a dry undulating plateau, the east is bordered by the Mekong River and delta, and the Kra Peninsula in the south is a tropical rain forest.[3]

Education in Thailand is compulsory between the ages of 7 and 15, carrying most students through the 7th grade. Only 83 percent of school-age children comply with the education attendance standards in Thailand, and as a result, the country had a 14.3 percent illiteracy rate in 1980, and a 16 percent illiteracy rate in 1983.[2]

Endowed with considerable natural resources, Thailand has demonstrated impressive growth in its domestic economy. Foreign trade and investment are an important part of the Thai economy, and external conditions substantially infuence the revenues of the Thai Government and the incomes of private citizens. The per capita income in Thailand is estimated to

be more than $785 annually. This places Thailand well into the middle range of the developing countries.[1] Agriculture has been the most important economic activity with over 80 percent of the population living in rural areas. The principal food crop is rice, and harvests are consistently larger than domestic consumption, leading to large exports each year.

The economy is managed within a free enterprise system with government regulation exercised mainly through the banking system. Social and economic trends include increasing urbanization, expansion of industrial activity at a faster rate than agriculture, and growth in incomes in service industries. These trends are often associated with growth and industrialization, but they have presented numerous problems for the Thai Government. Bangkok faces housing shortages and severe pressure on basic services, including water, electricity, and transportation.[2]

The mining industry accounted for $550 million or 1.5 percent of Thailand's gross national product in 1981. This industry's share of the national income has consistently been low for the past two decades. From an employment standpoint, mining in Thailand represents only a very small percentage of the nation's 23.4 million work force.[2] Table 5-1 shows the distribution of labor in Thailand in 1981. Unlike other Far East countries, Thailand's economic growth has not been restricted by a lack of natural resources; but because of an extremely high dependence upon imported energy, the country has not developed its industrial base in the same magnitude as South

Korea, Taiwan, and the Philippines. Much of this can be attributed to the Indochina Conflict which lasted from the early 1960's to 1975.

**Table 5-1. Distribution of Labor, 1981**

| Sector | Percentage of Labor Force |
|---|---|
| Agriculture | 76.0 |
| Industry and Commerce | 8.6 |
| Mining and Quarrying | 0.4 |
| Services | 9.0 |
| Government | 6.0 |

Source: Countries of the World and Their Leaders Yearbook, U. S. State Department, et al., 1984.

## GEOLOGY

The geology of Thailand is extremely varied and contains many different types of ore bodies. Late Paleozoic limestones, sandstones, and shales contain mineral deposits in veins and lodes; mostly imbedded in quartzite. Precious metals are found in alluvial and eluvial placers, and in some lode deposits. Granites, pegmatites, and sorted beach deposits contain titanium minerals. In the west part of Thailand, replacement deposits are most common, and occur along the southwest coast. The most important deposits in Thailand occur as placer deposits of tin, both onshore and offshore.[4] The geology of specific minerals is discussed in more depth in the mineral commodity analysis section of this chapter.

## RESOURCE/RESERVE BASE

An accurate survey of Thailand's mineral wealth is

essential to promote and encourage investment and development, but to date, with the exception of natural gas, very little progress has been made in estimating the sizes of mineral deposits. A major contributing factor to the lack of resource/reserve determination is the extensive and widespread poaching and smuggling of minerals in Thailand and the lack of a long-range minerals plan by the government.[5] Because of the government's almost total inability to stop the illegal mining activities, few large mineral corporations are willing to invest any money in calculating the size of reserves in Thailand.[6] Smuggling of minerals out of the country has become such a problem, and so extensive, that the government established a program in 1977 to buy minerals from the illegal mining operators to reduce the loss of government revenues caused by illegal export activities bypassing taxes and royalties.[7]

## GROSS NATIONAL PRODUCT

Thailand's agriculturally dominated economy has proven to be extremely sound, allowing growth in real terms despite oil shortages and world recessions. The Thai Government policy is to assume responsibility for infrastructural development, and it will only take an equity interest in essential enterprises where it is necessary to attract private venture capital.[8] As a result of this policy, Thailand has supported economic growth rates as high as 9.2 percent per year, more than all of its Southeast Asian rival countries except Singapore.[8]

Thailand has paid the price for rapid growth in recent

years, having to contend with high inflation rates, reaching as much as 11 percent in a single year, but the inflation has been reduced through government programs so that in 1983, it was below 5 percent.[9] Table 5-2 shows the trends of Thailand's gross national product since 1963 and the value and percentage representing the minerals and mining industries.

**Table 5-2. Thailand's Gross National Product**

| Year | GNP | Minerals and Mining | Percentage of GNP |
|---|---|---|---|
| 1963 | $3,001 | 45 | 1.5 |
| 1964 | 3,400 | 85 | 2.5 |
| 1965 | 3,800 | 110 | 2.9 |
| 1966 | 4,028 | 117 | 2.9 |
| 1967 | 4,700 | 80 | 1.7 |
| 1968 | 5,575 | 95 | 1.7 |
| 1969 | 5,929 | 107 | 1.8 |
| 1970 | 6,780 | 90 | 1.3 |
| 1971 | 6,910 | 114 | 1.6 |
| 1972 | 7,369 | 221 | 3.0 |
| 1973 | 9,328 | 220 | 1.0 |
| 1974 | 11,286 | 158 | 1.4 |
| 1975 | 14,800 | 170 | 1.2 |
| 1976 | 16,400 | 213 | 1.3 |
| 1977 | 18,000 | 360 | 2.0 |
| 1978 | 22,400 | 487 | 2.2 |
| 1979 | 26,800 | 676 | 2.4 |
| 1980 | 32,300 | 581 | 2.4 |
| 1981 | 35,272 | 550 | 1.6 |
| 1982 | 38,617 | 530 | 1.4 |

**Source:** Minerals Yearbook, U. S. Bureau of Mines, 1963-1982.

## NATIONAL DEBT

The Thai Government has been very successful in limiting the national debt until recent years, mostly by monitoring the public and private debt and taking corrective actions when the debt grows too rapidly. An example of such actions is the Thai Government taking away all tax credits for short-term

foreign loans in July 1983 because the amount of short-term foreign loans was spiralling. This action increased corporate expenses on a loan by 10 percent and encouraged them to secure loans with repayment periods of over 2 years.[10]

In 1983, the public and private debt in Thailand was estimated at $8.3 billion in long-term loans and $2.4 billion in short-term loans.[8] Presently, the national debt is approxiamtely $11 billion, growing mainly to cover the Thai Government's budget deficits.[11] The dramatic increase in oil prices caused Thailand's international payments deficit to go from $100 million in 1973 to $2.5 billion in 1981. To attempt to stabilize the economy and to sustain its economic growth rates, the Thai Government borrowed over $900 million from the International Monetary Fund in 1981.[12] Additionally, in 1982, the Thai Government obtained its first loan from the World Bank, in the amount of $150 million. Again, the purpose of this loan was to support the country's economic adjustment efforts, to pay for imports, and to offset trade deficits.[13] Lastly, in 1984, the Thai Government borrowed $85 million to pay the government's budget deficit. This money was borrowed from U. S. banking firms who are eager to lend money to Thailand. With a lower national debt than most other Asian countries, Thailand is considered to be a favored borrower.[11]

## ENERGY MIX

Historically, the population of Thailand has had adequate supplies of fuel in the form of wood-charcoal, rice husk,

and bagasse. Other energy sources existing in the 1950's were a very large hydroelectric power potential of the Chao Phraya River and smaller rivers, lignite deposits, and small oil deposits. After World War II, the need for more electricity grew rapidly and many industrial firms installed their own generators, mostly fueled by imported oil. The government attempted to meet domestic needs by constructing hydroelectric power generation complexes, oil-burning power plants, and lignite-fueled power plants. Over 70 percent of the nation's electricity is consumed by industry, and almost 30 percent of the villages in the country still do not have access to electric power.[3] Domestic energy sources include small oilfields, large lignite deposits, and a substantial hydroelectric capacity. Extensive, largely unevaluated oil shales are also known to exist, but are uneconomical to develop. In spite of these domestic energy sources, over two-thirds of all power generation plants are fueled by imported oil.[3]

Natural gas in Thailand is being developed by several large foreign firms in joint ventures. The Thai Government expects these natural gas ventures to improve the economy by reducing oil imports. The government also hopes to reduce its 75 percent import-dependence posture to 46 percent by 1987.[14]

## ENVIRONMENTAL CONSIDERATIONS

With the expansion of the use of vehicles and trucks, Thailand's port city of Bangkok is experiencing serious air and water pollution. The general attitude of the population

has been one of unconcern for the environmental impact of the country's modernization. This attitude may prevail for a long time because pollution in Thailand is not a problem in most of the country. In the past few years, a strong environmentalist group has formed in Thailand, which has become strong enough to influence future mineral exploitation in the country.[1]

In 1980, the Thai Government became concerned about the harmful effects of tin dredging on the fishery industry in the gulfs around the country. Three major companies were denied permission to dredge in Patong Bay, but illegal miners and dredgers continued to operate on a small scale, largely by using converted fishing boats to conduct operations.[7]

## INFRASTRUCTURE

Thailand has one of the best highway systems in Southeast Asia due to high allocations of government funds for road construction in the past 12 years. The primary road network consists of 13,000 kilometers, of which over 90 percent are paved. Secondary road nets include over 22,000 kilometers, many of which are impassable in the rainy season. Additionally, Thailand has over 60,000 kilometers of minor, primitive roads.[3] In 1982, nearly 4,000 kilometers of expressways were either completed, under construction, or being planned.[3]

Railroads in Thailand originate in Bangkok and run to national borders in all directions. The entire system is state-owned, and operated by the State Railway of Thailand Transportation Group, and is a very important transportation

sector for bulk commodities and passengers. The fifth 5-year plan (1982-1986) includes several improvements and expansions in the railway system in Thailand.[15]

Inland waterways have been the backbone of the Thai transportation system. An extensive network of waterways are formed by rivers, canals, and the Chao Phraya delta, carrying passengers, large quantities of rice, and freight. These waterways are navigable 700 kilometers inland during the wet season and about one-half that distance during the dry season. The drawback of using the canal system for transporting freight is that the barges are very slow, especially compared to trucks and railways.

Bangkok is the largest port in Thailand, handling 80-90 percent of the international cargo and about 40 percent of all coastal shipments. Other major ports include a deep sea port at Si Racha, which uses over 3 kilometers of conveyor belts to load and offload ships, and a large port at Sattahip, which was a military port until 1975. About 30 smaller ports line the coast along the Gulf of Thailand and the Andaman Sea, of which about 50 percent are exclusively fishing ports.[3]

Thailand has three international airports, located at Bangkok in the south, and Chiang Mai and Haddyai in the north and east, respectively. Domestic air service is available to 20 smaller cities and towns. International air service is available primarily by the Thai Airways International (THAI) from Bangkok and Chiang Mai to Asia, Middle East, Europe, the United States, and Australia.[3]

## MINING, PROCESSING, AND REFINING

Mining techniques in Thailand vary from extremely primitive to the most sophisticated dredging operations in the world. Most illegal offshore dredging operations are done from converted fishing boats using cutterhead suction dredges. Tin-bearing sand under 40 feet or more of water is sucked into hoselines and into sluice boxes in the boat for initial separation. More sophisticated, licensed dredging ships, built in Singapore, include several ships having advanced separating techniques, and one ship alone has a capacity of separating 400,000 cubic yards of sand and cassiterite per month.[7] The typical large dredge operating in the Tongkah Harbor has a capacity of 600 cubic yards per hour, digging up to 117 feet below the water surface.[5] Other minerals in Thailand are mined in open pit mines and some block cave mines. There is a widespread mining organizational concern about unconventional mining practices and almost a total lack of exploration programs. Unfortunately, these problems can only be corrected with government involvement. With the exceptions of tin, iron and steel, and zinc, Thailand does not refine its mineral production output. As a result, nearly all of the country's mineral exports are in the form of ore and concentrate.[16]

## INTERNATIONAL TRADE

Although Thailand's export trade at the beginning of the 1980's included a wide variety of products, eight principal items accounted for about three-fifths of the foreign exchange

earned through exports. These items were rice, rubber, tin, maize, cassava products, shrimp, sugar, and clothing. Primary and slightly processed agricultural products have continuously dominated Thailand's exports since the opening of trade with the West in the mid-1950's.[3] Beginning in the 1970's, the Thai Government modified its economic development plans to place more emphasis on export-oriented manufacturing, and beginning in 1971, the government actively encouraged the export of manufactured goods through the enactment of favorable tax and tariff measures. By the late 1970's, export diversification was well under way; exporting such items as television sets, small electrical machinery, electronics components, and other sophisticated goods.[3]

The largest trading partners with Thailand have been Japan and the United States, with trade deficits against Thailand since the late 1970's. Other trading partners include the European Economic Community, the Middle East, and other Asian countries. In 1982, the total imports amounted to $8.572 billion, while exports for the same year were only $6.955 billion.[17] The 1983 trade deficit was $3.09 billion, nearly twice that of 1982.[18]

The Thai Government is actively pursuing programs to reduce the trade deficit in the country. Present development plans for Thailand's infant natural gas industry call for liquid natural gas exports to absorb the entire trade deficit, and addtionally reduce oil imports through increased domestic consumption of natural gas.[19]

From a minerals aspect, Thailand exports more volume and value than it imports. Tables 5-3 and 5-4 show the principal mineral imports and exports, respectively, and trading partners.

## MINERAL COMMODITY ANALYSIS

In the late 1970's and early 1980's, Thailand's mineral industry began to grow dramatically. The most important mineral commodities in Thailand are tin, tungsten, lead, and tantalum. With the lack of a developed industrial base, Thailand's mineral industry is basically export-oriented, making the industry very vulnerable to world economic conditions. In 1982, the output of minerals, excluding natural gas, retreated markedly, owing to diminishing demand from industrial countries and a drop in prices of Thailand's more important commodities. These factors led to a reduction in production and, in some cases, the temporary closing of mines.[6] Even with the decline in output, Thailand ranked high among market economy countries as a producer of tantalum, first; tin, third; fluorite, fifth; barite, sixth; and tungsten, eighth. Thailand also produced domestically important quantities of marl, gypsum, limestone, cement, antimony, lead, manganese, lignite, and natural gas.[6]

In addition to the currently produced minerals, Thailand has one of the world's largest continuous deposits of rock salt. Large potash layers have been identified within the salt beds and are being investigated. These are the only known potash deposits in South and Southeast Asia, giving Thailand

Table 5-3. Principal Mineral Imports, 1981
(Metric Tons)

| Metals | Quantity | Trading Partner(s) |
|---|---|---|
| Aluminum | 73,825 | Canada<br>China<br>United States<br>Malaysia |
| Chromium | 1,867 | Philippines |
| Copper | 18,228 | Japan<br>Zambia |
| Gold (Troy Ounces) | 12,029 | United States |
| Iron and Steel | 1,853,794 | Japan<br>Italy<br>West Germany |
| Lead | 13,190 | Australia |
| Nickel | 2,143 | Republic of Korea |
| Silver (1000 Troy Ounces) | 6,208 | Japan |
| Titanium | 1,557 | Japan |
| Zinc | 39,540 | Australia<br>Canada |

| Non-Metals | Quantity | Trading Partner(s) |
|---|---|---|
| Asbestos | 57,193 | Canada<br>Botswana<br>Zimbabwe |
| Clays | 17,608 | United States |
| Fertilizers | 772,522 | United States<br>Japan<br>Europe |
| Sodium | 100,013 | United States<br>Romania<br>Japan |
| Sulfur | 30,048 | Canada |
| Talc | 13,458 | Republic of Korea |

| Mineral Fuels | Quantity | Trading Partner(s) |
|---|---|---|
| Coal | 32,655 | Other Asian Countries |
| Petroleum (1000 Barrels) | 60,401 | Saudi Arabia |
| Refined Petroleum (1000 Barrels) | 34,881 | Other Asian Countries |

Source: Minerals Yearbook, U. S. Bureau of Mines, 1982 Reprint.

Table 5-4. Principal Mineral Exports, 1981
(Metric Tons)

| Metals | Quantity | Trading Partner(s) |
|---|---|---|
| Antimony | 5,284 | European Countries |
| Iron and Steel | 61,609 | China |
| | | Iran |
| | | Hong Kong |
| Lead | 37,590 | West Germany |
| | | Japan |
| | | Netherlands |
| Manganese | 16,920 | Japan |
| | | Taiwan |
| Tin | 31,490 | Netherlands |
| | | United States |
| | | Japan |
| Tungsten | 1,993 | Netherlands |
| | | United States |
| | | New Zealand |
| **Non-Metals** | **Quantity** | **Trading Partner(s)** |
| Barite and Witherite | 234,091 | Indonesia |
| | | United States |
| | | Saudi Arabia |
| Clays | 35,585 | Other Asian Countries |
| Fluorspar | 221,838 | Japan |
| | | U.S.S.R. |
| | | Taiwan |
| Gypsum | 216,625 | Malaysia |
| | | Indonesia |
| | | Taiwan |
| Salt | 101,482 | Malaysia |
| | | Singapore |
| **Mineral Fuels** | **Quantity** | **Trading Partner(s)** |
| Lignite | 9,601 | Taiwan |
| Refined Petroleum (Barrels) | 52,251 | Other Asian Countries |

Source: Minerals Yearbook, U. S. Bureau of Mines, 1982 Reprint.

the potential of becoming a major regional supplier of $K_2O$ fertilizer.

Thailand is richly endowed with natural resources compared to other Far East nations. Table 5-5 shows at a glance the country's mineral imports, exports, production, and import dependence of most of the common minerals. Thailand's mineral industry has the capability of alleviating the country's financial problems, but the government is reluctant to strictly enforce mining laws and regulations that would encourage exploration and well-organized, large-scale operations.

## ENERGY MINERALS

### PETROLEUM

Thailand is almost totally dependent upon imported petroleum to satisfy domestic demands. Domestic production of crude oil has been consistently below 1,000,000 barrels per year since oil was first discovered. Presently, nearly all of the domestic crude oil production is by the Thai Shell Exploration Co., who produced over 693,000 barrels of crude oil in 1983.[20] New oil discoveries in December 1982 have led to a recent increase in domestic crude oil production. In 1983, production in the Kamphaeng Phet Province was 5000 barrels per day, with a proposed 17,000 barrels per day by 1985.[21] The Thai crude oil is low sulfur, high wax crude, making it difficult to refine, and the cost of transportation is high, all by rail, making the end cost of domestic crude oil more expensive than imported crude oil.[21] Crude oil is imported into

Table 5-5. Commodity Imports, Production, Exports, and Import Dependence (Units are in Metric Tons Unless Otherwise Specified).

| Commodity | Imports | Production | Exports | Import Dependence |
|---|---|---|---|---|
| Aluminum | 73,825 | 0 | 859 | 100 |
| Antimony | 13 | 2,261 | 5,284 | 0 |
| Chromium | 1,867 | 0 | 0 | 100 |
| Copper | 18,228 | 0 | 28 | 100 |
| Gold (Troy Ounces) | 12,029 | 0 | 373 | 100 |
| Iron and Steel | 1,853,794 | 779,379* | 61,609 | 100 |
| Lead | 13,190 | 19,429* | 37,590 | 0 |
| Magnesium | 36 | 0 | 26 | 100 |
| Manganese | 559 | 7,758 | 16,920 | 0 |
| Nickel | 2,143 | 0 | 0 | 0 |
| Silver (1000 Troy Ounces) | 6,208 | 0 | 1,016 | 100 |
| Tin | 26 | 51,500 | 31,490 | 0 |
| Titanium | 1,557 | 18 | 12 | 100 |
| Tungsten | 32 | 2,516 | 1,993 | 0 |
| Zinc | 39,540 | 0 | 441 | 100 |
| Asbestos | 57,193 | 0 | 0 | 100 |
| Barite/Witherite | 36 | 318,348 | 234,091 | 0 |
| Cement | 108,532 | 6,609,000 | 55,861 | 0 |
| Clays | 17,608 | 20,046* | 38,585 | 0 |
| Fertilizers | 772,522 | 4,265 | 1,763 | 100 |
| Fluorspar | 3,056 | 356,000 | 221,838 | 1 |
| Graphite | 864 | 630 | 0 | 88 |
| Gypsum | 250 | 753,433 | 216,625 | 0 |
| Salt | 345 | 176,100 | 101,482 | 0 |
| Sodium | 100,013 | 0 | 2 | 100 |
| Sulfur | 30,048 | 0 | 269 | 100 |
| Talc | 13,458 | 21,998 | 2,384 | 41 |
| Coal | 32,655 | 1,964,000 | 9,601 | 2 |
| Petroleum (1000 Barrels) | 95,282 | 58,636* | 52 | 72 |

*Production from imported raw materials.

Source: Minerals Yearbook, U. S. Bureau of Mines, 1982 Reprint.

Thailand from Saudi Arabia, Qatar, and Malaysia, in order of importance.[16] Nearly all of the refinery output in Thailand is from imported crude oil. Thailand has three oil refineries operated by the Thai Refinery Co. and the ESSO Standard Thailand Corp. Reserves of crude oil in Thailand have been estimated to be about 30 million barrels in 1982.[16] Figure 5-1 shows imports, exports, and production of crude oil and refined petroleum in Thailand. The 1973 oil embargo caused a short-term decrease in oil imports, and as predicted, imports have declined since 1981 as the use of heavy fuel oil to power electric power plants and furnaces is phased out in favor of the less-costly natural gas.[16]

COAL

Coal production in Thailand is limited to lignite, the only type of coal found in the country. Until in the mid-1970's, the economic feasibility of exploiting Thailand's lignite deposits did not attract very much attention, but with the rise in oil prices since 1973, these lignite deposits have taken on considerable new importance.

Most of the lignite mining is done for electrical power generation at the mine sites. The Electricity Generating Authority of Thailand has continuously, in the past decade, explored for new deposits and additional reserves. Indicated lignite reserves are presently estimated to be about 1400 million tons, of which up to 650 million tons can be mined with relatively unsophisticated mining techniques. Proven reserves

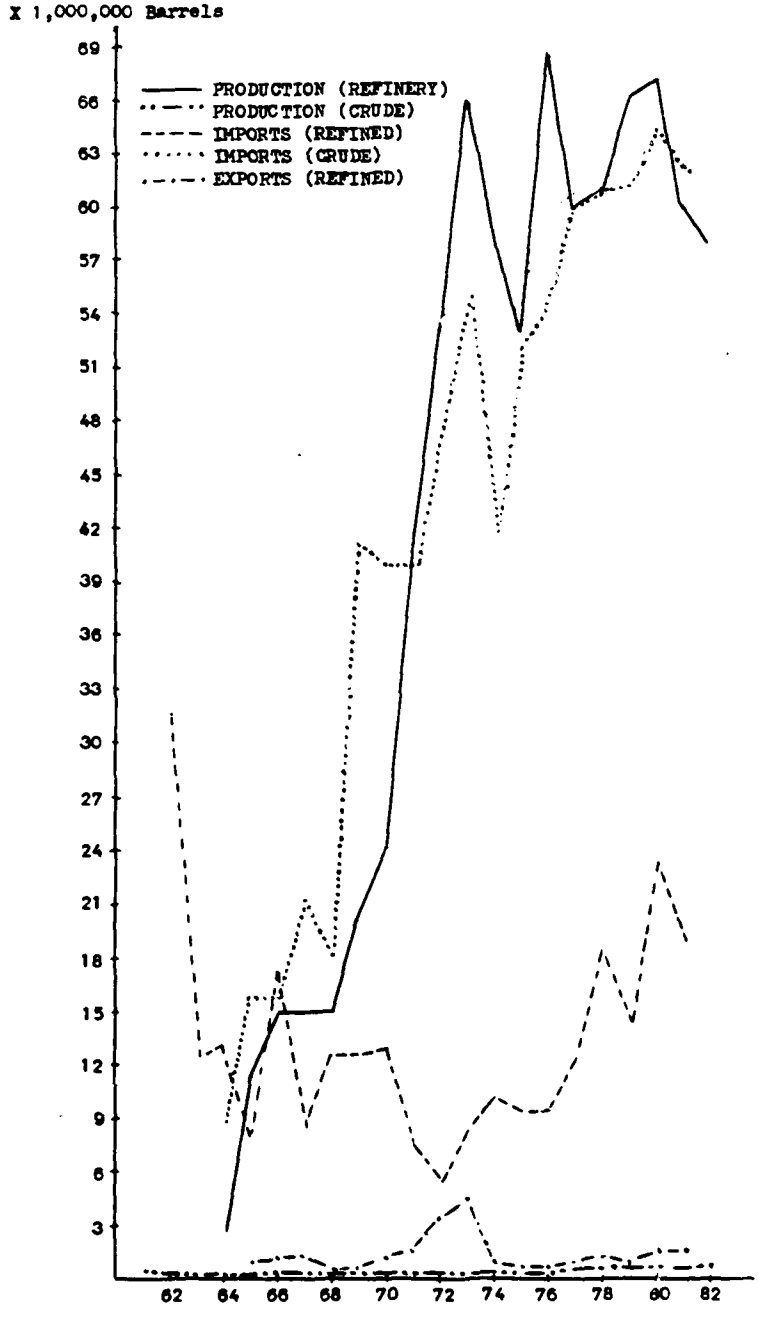



Figure 5-1: Annual Production, Imports, and Exports of Petroleum in Thailand, 1961-1982.
Source: Minerals Yearbook, U. S. Bureau of Mines.

of 78 million tons are located in three deposits in the Lampang and Lamphun Provinces.[16] Figure 5-2 shows the production and import patterns of coal in Thailand. Approximately one-half of the imports are coking coal for Thailand's steel industry.

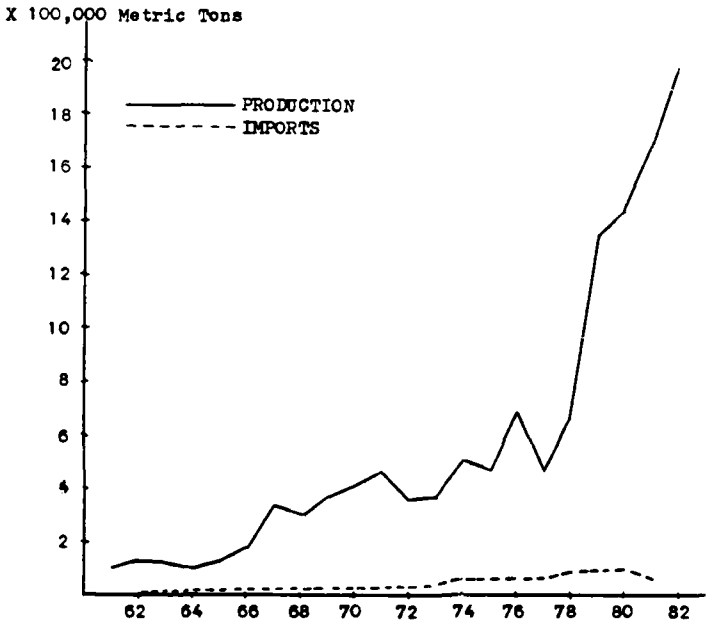



**Figure 5-2: Annual Production and Imports of Coal in Thailand, 1961-1982.**
**Source: Minerals Yearbook, U. S. Bureau of Mines.**

NATURAL GAS

On September 12, 1981, the valves were opened at Ban Habtaput to bring the first commercial natural gas production ashore from Union Oil Co. of Thailand's Erawan Gasfield. Production began after nine years of development.[22] The Thai Government expects the natural gas production to continue to increase. The government is also hoping that the completion of a natural gas segregation plant will trigger a string of

petrochemical-related industries.[14]

Natural gas in Thailand is pipelined 264 miles to shore in the world's longest sea floor gas pipeline. Union Oil Co. has had an extremely difficult task meeting production targets in the new gasfields. As a result of contractual disputes, the Thai Government levied over $40 million in fines against Union Oil, but has since then accepted reports that the company was not negligent.[23] This was an important decision in view of the fact that more companies are needed to fully exploit Thailand's natural gas resources. The Thai Government has offered concessions to four large American companies to explore for oil and natural gas, and because of both on-and offshore discoveries, the reserves of natural gas in Thailand have grown to over 16 trillion cubic feet.[24] Table 5-6 shows the natural gas reserves in Thailand as of May 1983.

**Table 5-6. Thailand's Natural Gas Reserves (Trillion Cubic Feet)**

| Gasfield | Company Involved | Reserve Estimate |
|---|---|---|
| Erawan Gasfield | Union Oil Company of Thailand | 1.8 |
| "B" Gasfield | Texas Pacific Oil Company | 7.2 |
| Kaphong-Plathong Gasfield | Union Oil Company of Thailand | 1.3 |
| Baanpot Gasfield | Union Oil Company of Thailand | .8 |
| Satun Gasfield | Union Oil Company of Thailand | 3.2 |
| "E" Gasfield | Texas Pacific Oil Company | .2 |
| Pla-Dang Gasfield | Union Oil Company of Thailand | .6 |
| Jakrawan Gasfield | Union Oil Company of Thailand | 1.0 |
| North Pla-Dang Gasfield | Union Oil Company of Thailand | TBD |
| Funan Gasfield | Union Oil Company of Thailand | TBD |
| Trat Gasfield | Union Oil Company of Thailand | TBD |
| Pakarang Gasfield | Union Oil Company of Thailand | TBD |

TBD--Reserves to be determined.

Source: Oil and Gas Journal, May 16, 1983.

## METALLIC MINERALS

### ALUMINUM

Thailand is totally dependent upon imports for aluminum supplies, importing metal from Canada, the United States, Australia, and Ghana; oxides and hydroxides are imported from China and Japan; and ore and concentrate from Malaysia, Canada, and China; all in order of importance.[16] Figure 5-3 shows import trends of aluminum in Thailand. Of particular importance is the large increase in imports of metal in the early 1970's, and a slump in 1974-1976, because of world energy problems.[22]

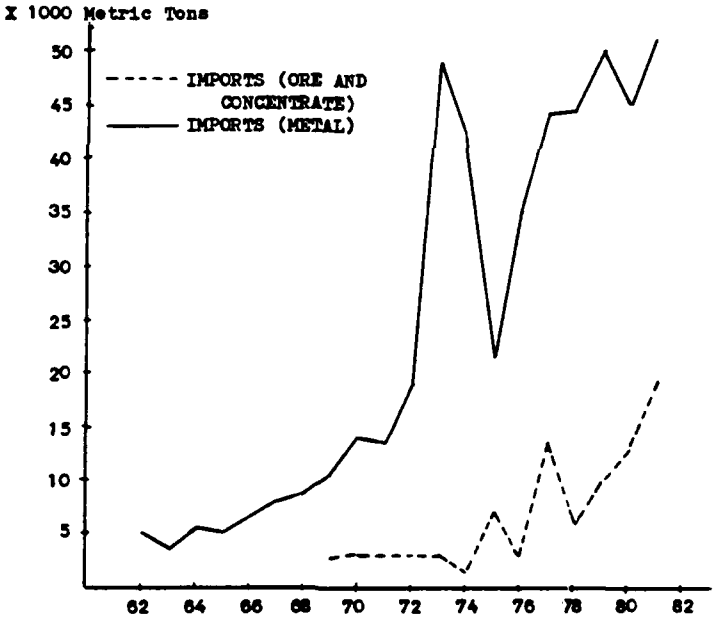



**Figure 5-3: Annual Imports of Aluminum in Thailand, 1961-1982. Source: Minerals Yearbook, U. S. Bureau of Mines.**

### ANTIMONY

Stibnite, the source mineral of antimony, occurs in Thailand as brecciated, irregular, and lenticular shoots in

dark gray quartzite, in limestones, sandstones, and shales of late Paleozoic age. These deposits are commonly associated with nearby porphyry intrusions.[4]

Antimony is an important export commodity in Thailand, found in many parts of the country. It is mined in small-scale operations that are highly sensitive to price changes. When the price falls too low, the diggings simply close down until the price recovers. Because of large price fluctuations over the past 10 years, and the weak, unstable market conditions, many mine owners are reluctant to make capital investments necessary to modernize their mines. As a result, much of the antimony in Thailand is mined using manual labor and production has been declining.[26] Figure 5-4 shows production and exports of antimony in Thailand. The country produces about one-fifth of the world's output, and the majority of the exports are in the form of ore and concentrate. The two major increases in production; 1964 and 1973, are the result of new mines being opened.[27]

CHROMIUM

Thailand must import all of its chromium to satisfy domestic demand. Domestic production of chromium was adequate to meet demands only until 1974, and since that year, the low-grade, small-scale chromite mining operations have become uneconomical and were closed down completely by 1979.[27] Figure 5-5 shows the chromium import and export patterns in Thailand. Particularly noteworthy is the "1974 break" affecting production.

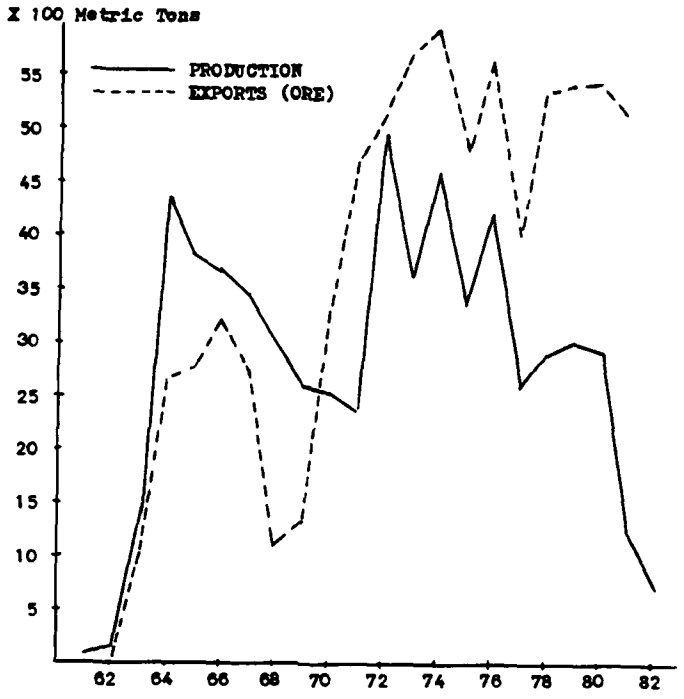



Figure 5-4: Annual Production and Exports of Antimony in Thailand, 1961-1982.
Source: Minerals Yearbook, U. S. Bureau of Mines.

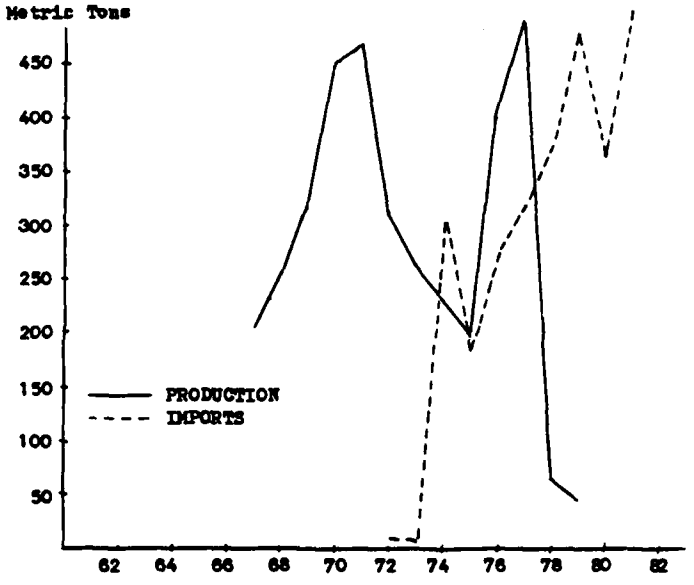



Figure 5-5: Annual Production and Imports of Chromium in Thailand, 1961-1982.
Source: Minerals Yearbook, U. S. Bureau of Mines.

COPPER

Thailand has copper deposits in the form of chalcopyrite, chalcosite, azurite, malachite, cuprite, and native copper, but because of low grades, all of the country's copper supplies are imported, mainly from the United States, other Asian countries, and Africa.[27] Figure 5-6 shows the import pattern of copper in Thailand.

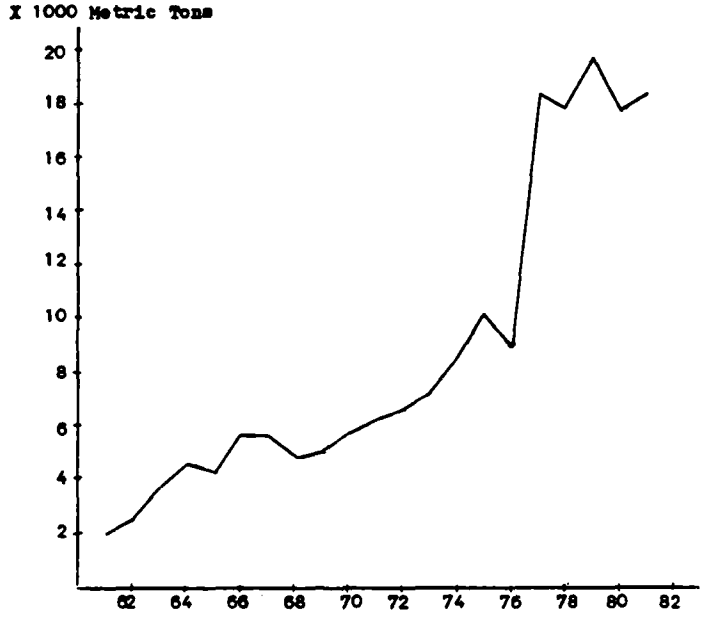



**Figure 5-6: Annual Copper Imports in Thailand, 1961-1982.**
**Source: Minerals Yearbook, U. S. Bureau of Mines.**

TUNGSTEN

Tungsten occurs in Thailand as a byproduct of tin placer deposits, both on-and offshore. Wolframite, the base mineral, also occurs in fissure veins, stockworks, and pegmatities carrying both wolframite and cassiterite.[4] These deposits are closely associated with granites. Scheelite occurs in northern

Thailand and ferberite and huebnerite occur in the south. Thailand has 16 tungsten mines and 166 tin-tungsten placer mines.[28] Figure 5-7 shows the production and exports of tungsten in Thailand.

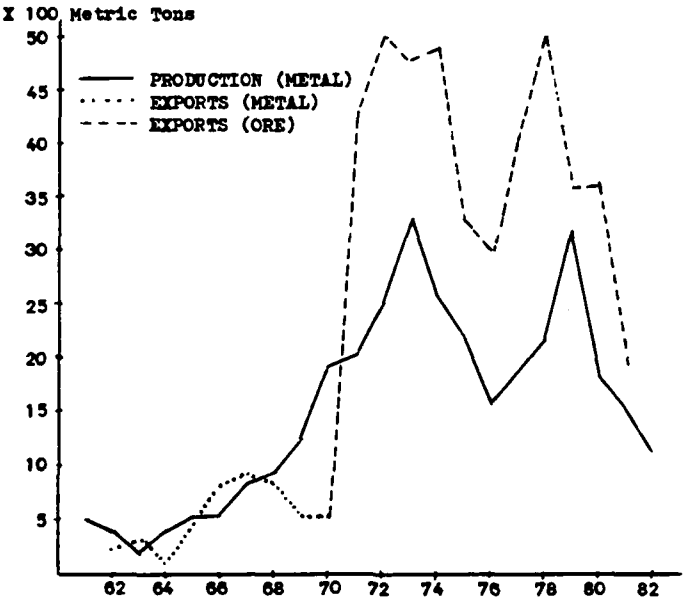



**Figure 5-7: Annual Production and Exports of Tungsten in Thailand, 1961-1982.**
**Source: Minerals Yearbook, U. S. Bureau of Mines.**

Most of the tungsten mining in Thailand is done by illegal miners, dredgers, and smugglers, so the production statistics are probably lower than actual output.[6] Stora Kopperbergs Bergslangs AB, a Swedish mining company has a 45 percent interest in Thailand's largest tungsten mine, an open pit mine designed to produce over 430 tons of tungsten metal per year. Production and exports of tungsten have been declining in recent years because of depressed prices, a high fixed royalty, increased operating costs, the closing of several mines, and

declining ore grades in the northern deposits.[16]

NICKEL

Thailand is 100 percent import-dependent for nickel supplies, importing most of them as metals from the Republic of Korea, Europe, and Australia.[27] Figure 5-8 shows the import pattern of nickel in Thailand.

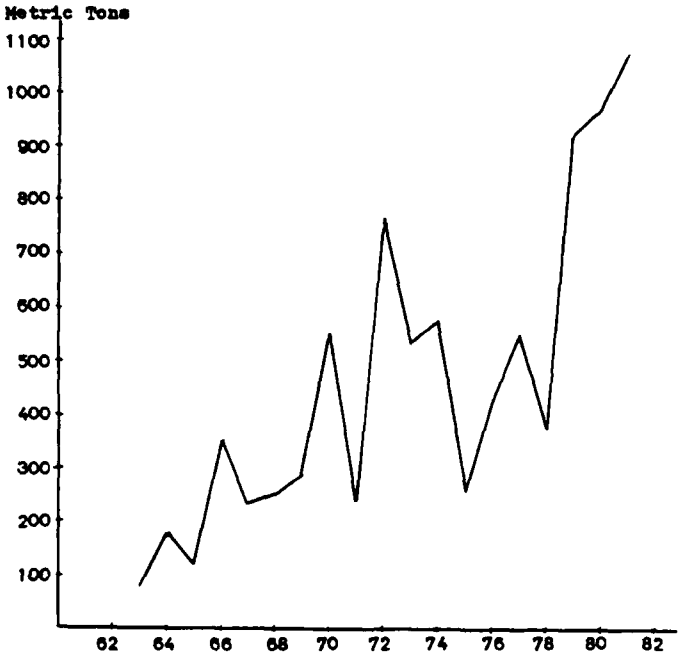



**Figure 5-8: Annual Nickel Imports in Thailand, 1961-1982. Source: Minerals Yearbook, U. S. Bureau of Mines.**

MANGANESE

Manganese occurs in Thailand as sedimentary deposits containing leached manganiferous sediments, concentrating the manganese through natural processes. Manganese oxides contain as much as 46 percent manganese, and occur as beach deposits on the southwest coast.[4] Most of the manganese output in Thailand

is exported as ore and concentrate, and much of the domestic consumption in Thailand is used in dry cell battery manufacturing by several dry cell companies.[27] Figure 5-9 shows the production, import, and export patterns of manganese in Thailand. The close relationship between production, which comes from 11 mines, and exports indicates the fact that nearly all of Thailand's production is for export.

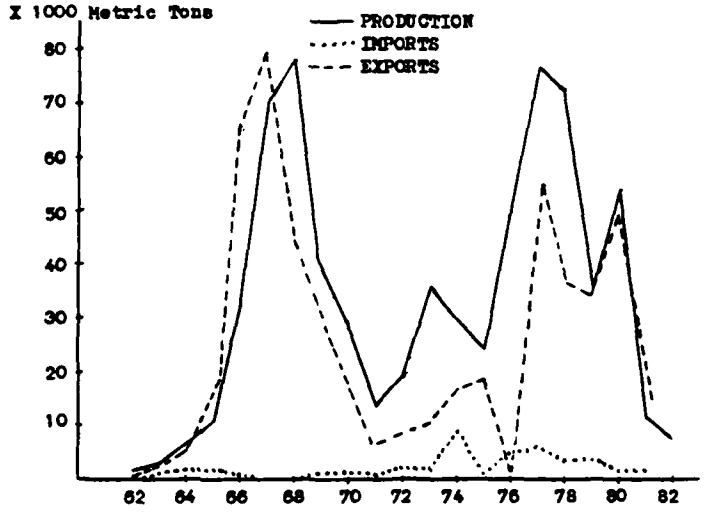



Figure 5-9: Annual Production, Imports, and Exports of Manganese in Thailand, 1961-1982.
Source: Minerals Yearbook, U. S. Bureau of Mines.

IRON AND STEEL

Thailand has low-grade iron laterites that are widespread throughout the country, forming surficial blankets on many bedrocks associated with contact metamorphic deposits where igneous rocks have intruded calcareous sediments. Most of these deposits contain magnetite.[4]

The Thai steel industry has really never progressed

past infant stages. Plans for major new steelmaking facilities have been intensely debated for several years. The basic problem has been what kind of facility would be economically viable in a country that has no known favorable iron ores, no coking coal, high energy costs, and enthusiastic environmental groups, seemingly capable of stalling any plan not meeting their approval.[27] As a result, plans for expanding the existing steel industry have been scrapped. The steelmaking industry in Thailand is in the hands of seven electric-furnace-based plants, operated by United States Steel, Bangkok Iron and Steel Works Ltd., Siam Iron and Steel Co., and Bangkok Iron and Steel Co.[22] Figure 5-10 shows production, imports, and exports of iron and steel in Thailand. The steelmakers have been suffering large monetary losses because of depressed demand and fierce price competition, and have been operating at only 40 percent capacity since 1981.[16]

TIN

Thailand is the fourth largest tin producer in the world, having the third largest of all reserves. Tin is found in granite-bearing mountain ranges all over the country, and is mined in 32 lode mines and widespread placer deposits, accounting for over 90 percent of all of the tin produced in the country.[29] Tin, occuring as placer deposits, both on-and off-shore, is the most important mineral produced in Thailand, in terms of employment, tax revenue, and foreign exchange earnings. Tin accounts for approximately 90 percent of the non-fuel

mineral royalty paid to the Thai Government and over 80 percent of mineral export earnings. 1980 was the peak year for tin production and exports, leading to payments of $165 million in royalties and exports valued at over $585 million.[7]

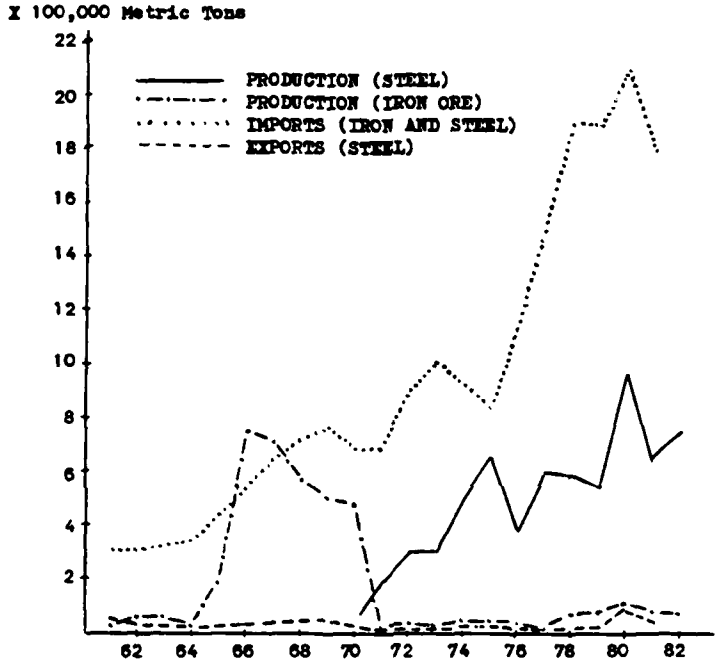



**Figure 5-10: Annual Production, Imports, and Exports of Iron and Steel in Thailand, 1961-1982. Source: Minerals Yearbook, U. S. Bureau of Mines.**

Tin has been used in Thailand since 200 A. D. in bronze Buddhist images. The major workings of tin are along the southern peninsula where it is found in onshore alluvial deposits, in situ weathered and disintegrated formations, river beds, and in offshore deposits along the coast.[3] Cassiterite, in placer deposits, occurs as free grains, fairly coarse-grained up to 3 millimeters in diameter. Processing this ore requires no crushing or grinding, and gravity segregation methods yield

high recovery rates. The mineral is mined using dredges and the ore is screened on the dredge to one-half inch size, then it is fed to jigs producing one percent tin. Further jigging yields 20 percent tin concentrate. The recovery rate is 95 percent on the more sophisticated dredges, but is considerably lower on the majority of Thailand's tin dredgers. Lode ores require fine grinding because the cassiterite is associated with other minerals. Then the tin is extracted using gravity methods. Recovery by flotation is gradually replacing gravity methods in large-scale operations.[30]

Tin production in Thailand has been declining because of depressed demand in most industrialized countries, reduced export prices, and the sale of tin from the United States' strategic stockpile. To encourage tin producers to continue production, the Thai Government has established its own buffer stockpile and reduced tin royalties to 13 cents per pound. But, as more of the rich offshore deposits become depleted, mining exploration will have to be stepped up and mining new areas will cause conflicts with environmentalists.[16] Figure 5-11 shows production and export trends of tin in Thailand, showing that nearly all production of ore and metal is for export. Tin smelting is now permitted in Thailand by the Thai Government, but before September 1977, the Thai Smelting and Refining Co. maintained a foreign-owned monopoly on all tin smelting in the country.[27]

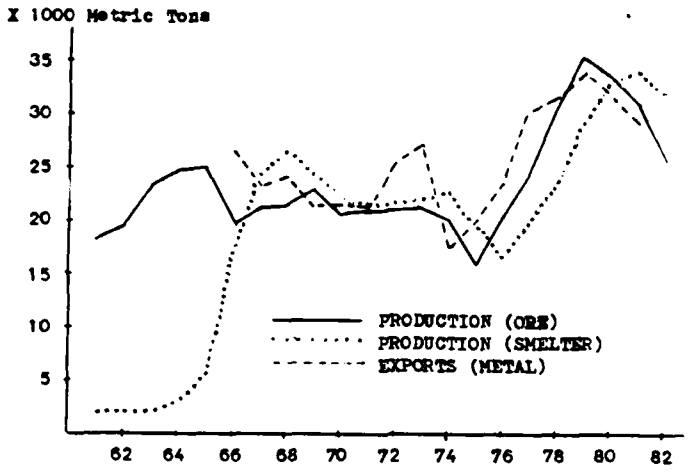



Figure 5-11: Annual Production and Exports of Tin in Thailand, 1961-1982.
Source: Minerals Yearbook, U. S. Bureau of Mines.

COLUMBIUM AND TANTALUM

High prices of tantalum and columbium in 1979 triggered the processing of tin smelter slag to extract these metals. By 1981, tantalum was the second biggest foreign exchange earner in the Thai mineral industry, accounting for a major portion of the world's output.[7]

Construction of Thailand's first tantalum and columbium processing plant was financed by the World Bank in 1982. Groundbreaking for the plant began immediately, but because of delays, it will not be completed until 1986. When completed, Thailand will be able to earn more foreign exchange by exporting higher value ferrotantalum, tantalum, and columbium oxides. Figure 5-12 shows the production and export patterns of tantalum and columbium in Thailand.[16]

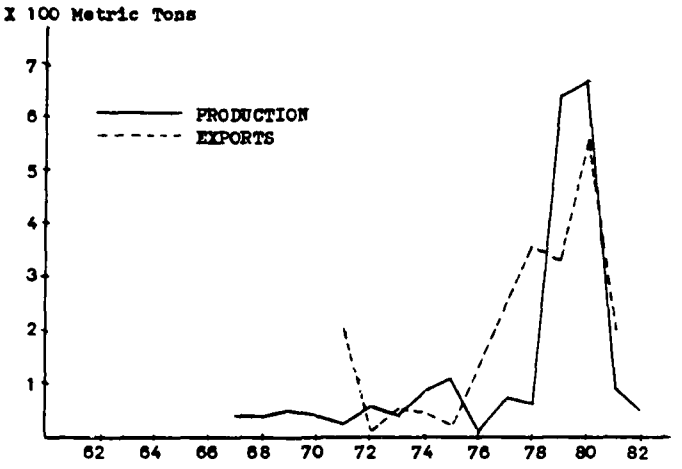



Figure 5-12: Annual Production and Exports of Columbium and Tantalum Ores and Concentrates in Thailand, 1961-1982.
Source: Minerals Yearbook, U. S. Bureau of Mines.

LEAD

Lead occurs, with zinc, in small veins in replacement deposits in northern Thailand and in veins in the west, which are most promising economically. A major lead-zinc deposit is also located in southern Thailand, in the center of a tungsten-tin lode, near the Malaysian border.[4]

Production of lead in Thailand has not been a significant industry until very recently. Most exports were ore and concentrate, and most imports were unwrought lead. In 1978, a lead deposit was developed west of Bangkok, leading to the construction of a beneficiation plant. Since then, lead production and exports have greatly increased, owing almost all of the increase to the new facility.[26] Figure 5-13 shows the import, export, and production trends of lead in Thailand.

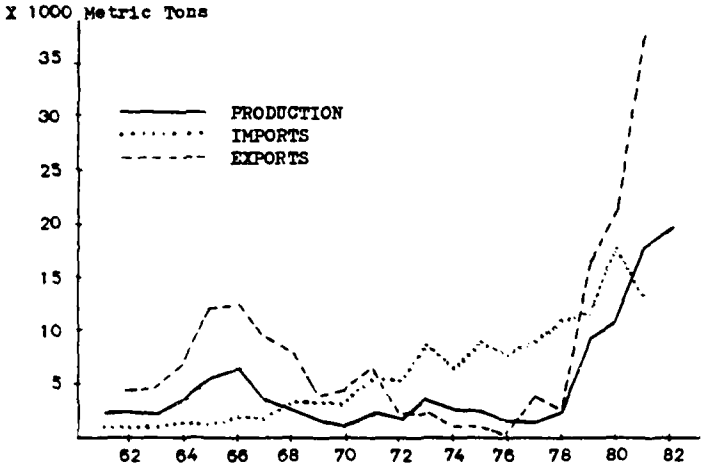



Figure 5-13: Annual Production, Imports, and Exports of Lead in Thailand, 1961-1982.
Source: Minerals Yearbook, U. S. Bureau of Mines.

MOLYBDENUM

Powellite and molybdenite occur as accessory minerals associated with tin-tungsten veins.[4] Thailand does not report any production of molybdenum and import statistics indicate that only small amounts (less than one ton per year) are imported.[27] It is possible that Thailand extracts molybdenum as a byproduct of tin and tungsten.

MERCURY

Thailand is 100 percent import-dependent for mercury supplies, importing them from China, Japan, and West Germany.[27] Figure 5-14 shows the import pattern of mercury in Thailand.

TITANIUM

Thailand imports nearly all of its titanium for use in pigments. Ilmenite extraction from tin smelting slag accounts for 60-90 percent of domestic production. Ilmenite is found in

Thailand associated with cassiterite, occuring in granites, pegmatites, and veins. Also some sorted beach deposits contain as much as 40-50 percent ilmenite.[4] Figure 5-15 shows production and import patterns of titanium in Thailand.

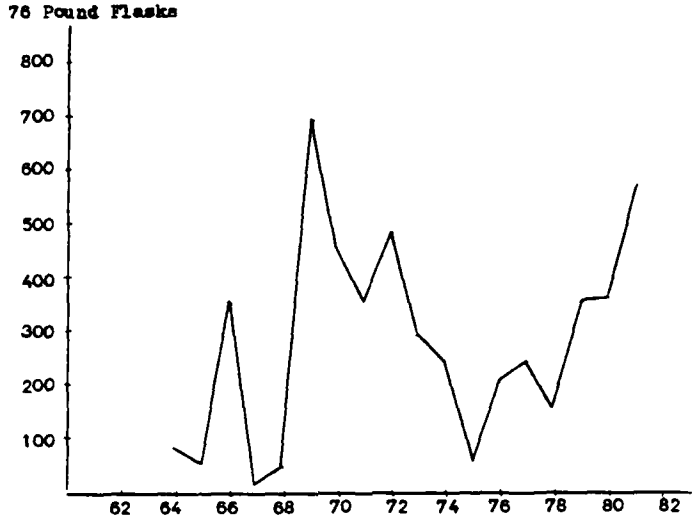



Figure 5-14: Annual Imports of Mercury in Thailand, 1961-1982.
Source: Minerals Yearbook, U. S. Bureau of Mines.

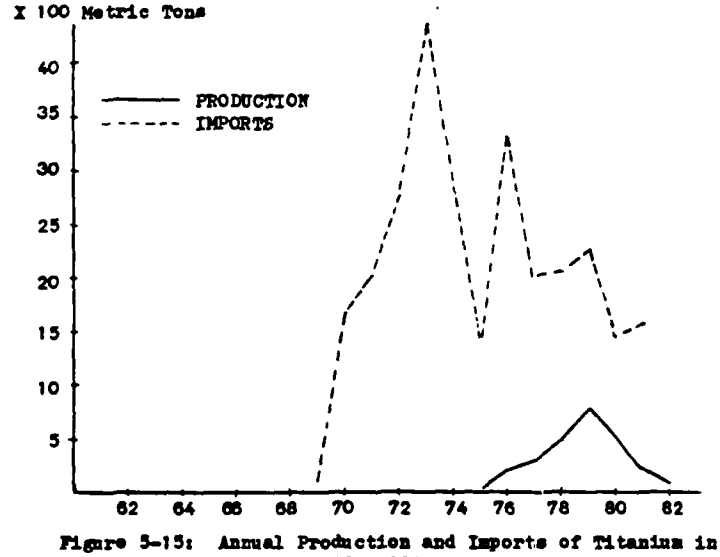



Figure 5-15: Annual Production and Imports of Titanium in Thailand, 1961-1982.
Source: Minerals Yearbook, U. S. Bureau of Mines.

ZINC

Thailand has traditionally been dependent upon imports for most of its zinc requirements, but in 1974, a large zinc deposit, discovered in the late 1960's, was developed, enabling the Thai Zinc Ltd., a subsidiary of New Jersey Zinc Co., to produce over 143,000 tons of zinc ore, assaying out to 23 percent zinc. Total reserves of this zinc deposit were estimated to be 3.5 million tons.[27] Approximately one-half of the zinc was exported as concentrate to New Jersey Zinc's processing plant in Pennsylvania, but in 1978, all shipments of zinc concentrate to the United States were suspended, awaiting the approval of a zinc refinery in Thailand. In 1981, a 66,000 ton-per-year capacity zinc smelter was approved in northern Thailand. Thai investors financed 67 percent; Belgian investors, 30 percent; and Japan, 3 percent. Plant completion is set for 1984, and proven reserves in the area give it an 11 year life. This project has been delayed many times because of government bureaucracy. Joint venture experiences with this plant have discouraged other overseas investors in Thailand.[31] Figure 5-16 shows annual production, import, and export patterns of zinc in Thailand. When the new smelter is completed, Thailand's import-dependence will decrease significantly.

ZIRCON

Thailand has been a significant producer of zircon ore and concentrate in the past as shown in Figure 5-17. In recent years, production was low because of weak market prices and

increasing operating costs.

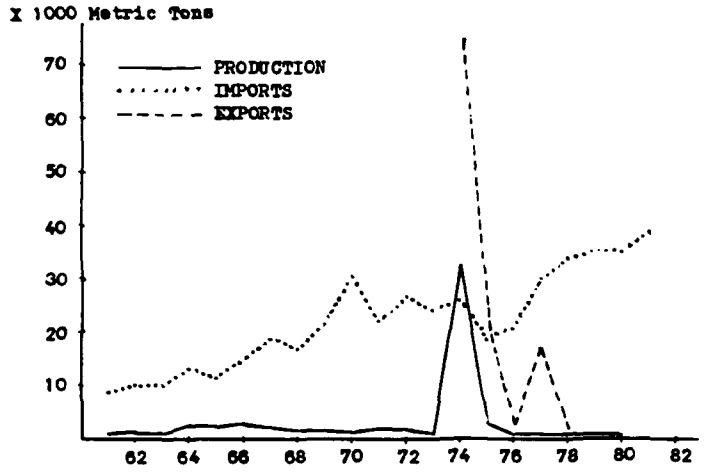



Figure 5-16: Annual Production, Imports, and Exports of Zinc in Thailand, 1961-1982.
Source: Minerals Yearbook, U. S. Bureau of Mines.

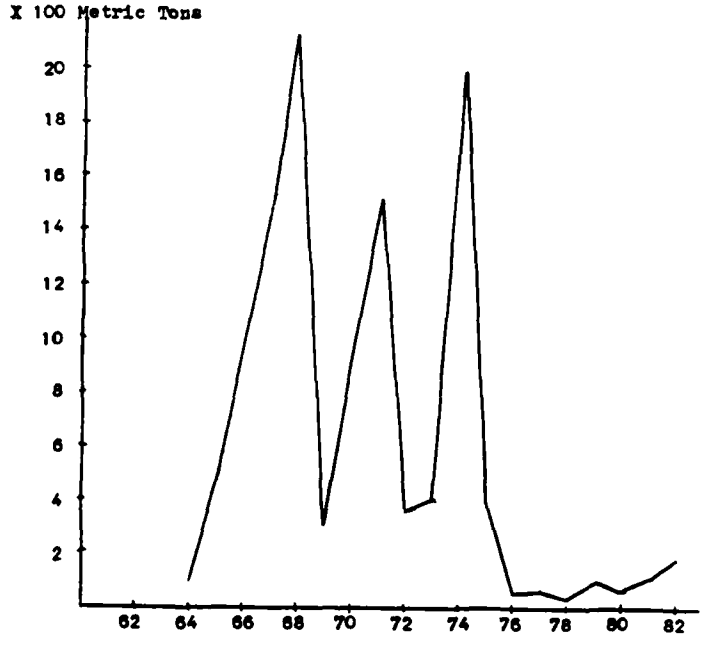



Figure 5-17: Annual Production of Zircon in Thailand, 1961-1982.
Source: Minerals Yearbook, U. S. Bureau of Mines.

PLATINUM GROUP METALS

Thailand imported a significant amount of platinum group metals in the early 1970's, but since 1974, imports have been significantly lower, as shown in Figure 5-18. The import source of platinum has been Japan.

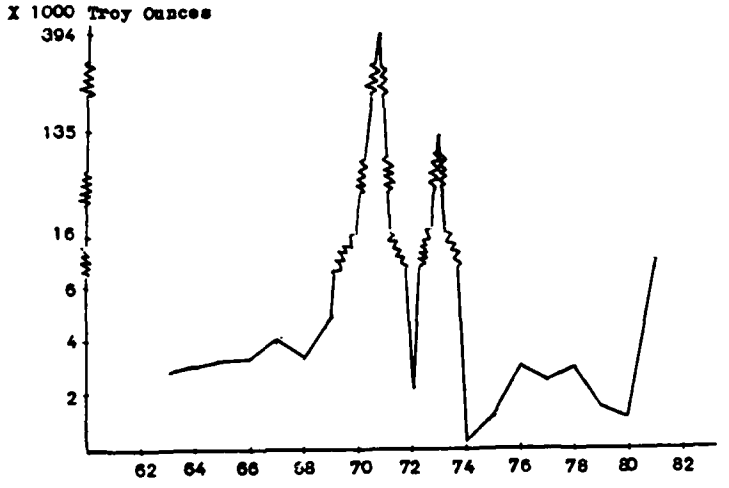



**Figure 5-18:** Annual Imports of Platinum Group Metals in Thailand, 1961-1982.
Source: Minerals Yearbook, U. S. Bureau of Mines.

SILVER

Thailand does not have any silver ore deposits and imports all of its requirements. The principal source of silver is the United Kingdom. Figure 5-19 shows import and export patterns of silver in Thailand.

GOLD

Thailand does not report any reserves or production of gold. Import statistics show that large amounts of gold were imported in 1972 and 1978, almost all from the United States, but no explanation was provided. Figure 5-20 shows the erratic

import pattern of gold in Thailand.

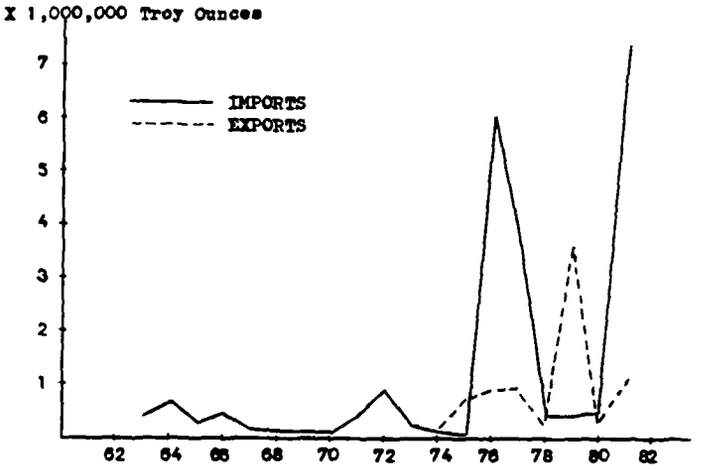



Figure 5-19: Annual Imports and Exports of Silver in Thailand, 1961-1982.
Source: Minerals Yearbook, U. S. Bureau of Mines.

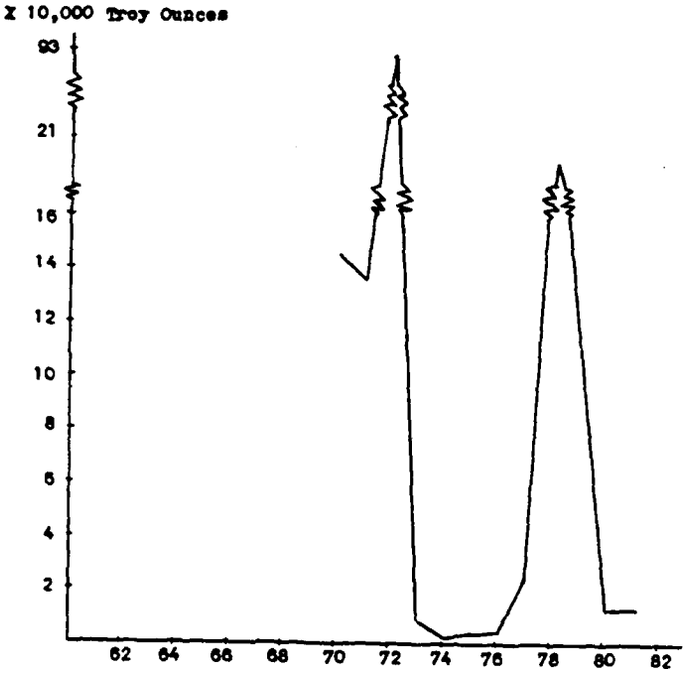



Figure 5-20: Annual Gold Imports in Thailand, 1961-1982.
Source: Minerals Yearbook, U. S. Bureau of Mines.

It could be assumed that gold is produced in Thailand because there are many gold deposits, mostly eluvial and alluvial placers, and some lode deposits.[4]

## NON-METALLIC MINERALS

### ASBESTOS

Thailand is 100 percent import-dependent for asbestos supplies, obtaining them from Canada, Botswana, Zimbabwe, and the United States, in order of importance. Figure 5-21 shows the increasing import requirements of asbestos in Thailand.

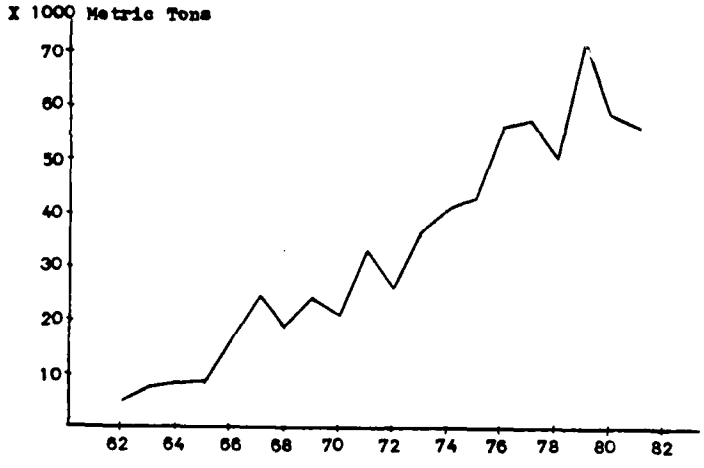



**Figure 5-21: Annual Imports of Asbestos in Thailand, 1961-1982. Source: Minerals Yearbook, U. S. Bureau of Mines.**

### BARITE AND WITHERITE

Barite veins associated with igneous rocks and lenses or beds of barite and witherite in sedimentary rocks occur in the northern part of Thailand as the principal gangue mineral in epithermal lead and copper veins. The barite of Thailand is milky and massive, occuring as pure varite lenses in

sandstones.[4]

Barite is used primarily by the international oil industry in heavy drilling mud. Production of barite in Thailand began in 1970, and is used in domestic drilling and for exports to other Southeast Asian countries. Thailand is the principal source of barite to Southeast Asia, and the level of production and exports is dependent upon the amount of oil and gas drilling being conducted both domestically and abroad.[27] Figure 5-22 shows the production and export patterns of barite in Thailand, indicating a reduction of domestic drilling in 1975-1976, and then a sudden increase in drilling beginning in 1978, when natural gas was discovered in Thailand.

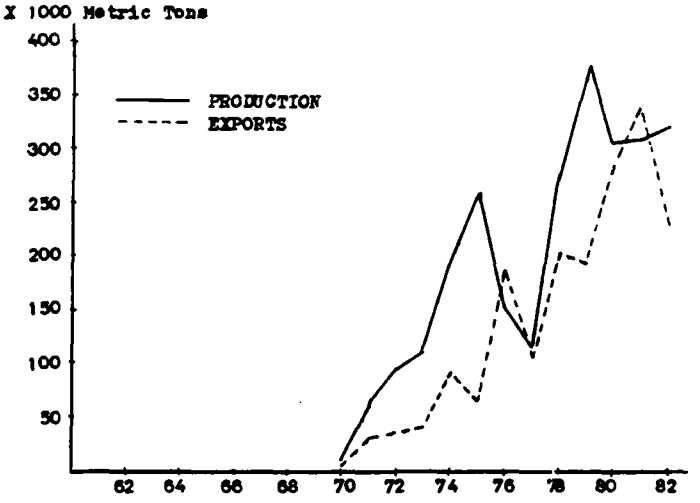



**Figure 5-22: Annual Production and Exports of Barite in Thailand, 1961-1982.**
**Source: Minerals Yearbook, U. S. Bureau of Mines.**

CLAY

Thailand is not as active in producing clay and clay products as many other Far East countries are. Production, imports, and exports have been quite modest as shown in Figure 5-23. The only significant occurrence was that kaolin clay production tripled in 1974, but had no market, so production returned to normal levels the next year.[27]

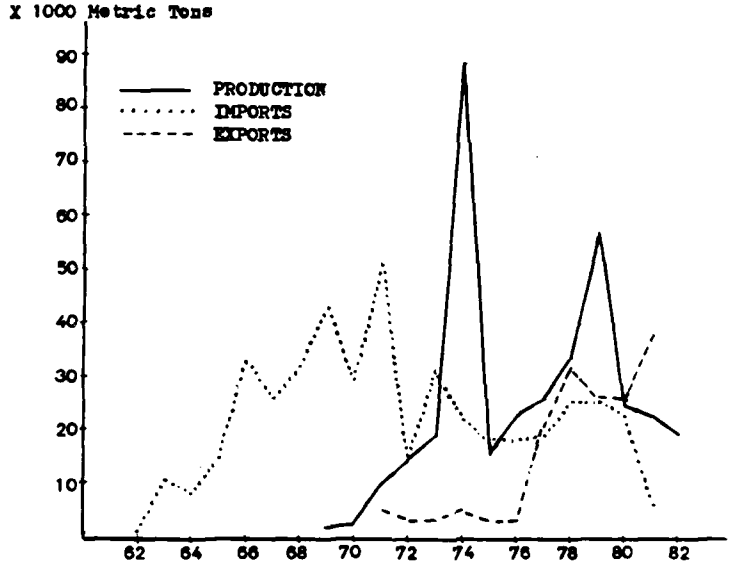



**Figure 5-23: Annual Production, Imports, and Exports of Clay and Clay Products in Thailand, 1961-1982. Source: Minerals Yearbook, U. S. Bureau of Mines.**

CEMENT

Cement production in Thailand has been steadily increasing every year since in the 1950's. The Thai Government, like other governments, dissapproves of importing low value-per-ton commodities such as cement. Production capacity expansion programs are approved whenever domestic demand cannot

be satisfied with all cement plants operating at capacity.[27]

With energy accounting for over 50 percent of operating costs, much emphasis is being placed on constructing natural gas pipelines to fuel the cement kilns. This prospect is a relatively new idea, and is expected to be implemented by 1985 or 1986.[16] Figure 5-24 shows the production, imports and exports patterns of cement in Thailand.

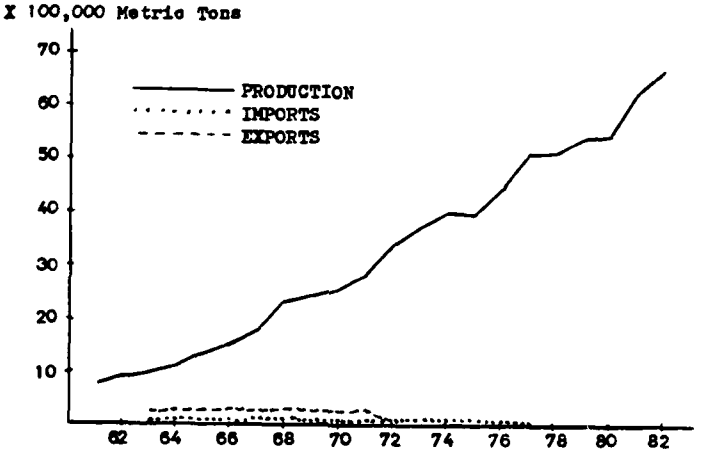



**Figure 5-24: Annual Production, Imports, and Exports of Cement in Thailand, 1961-1982.**
**Source: Minerals Yearbook, U. S. Bureau of Mines.**

FLUORSPAR

Fluorite in Thailand is, in many cases, sought as a gemstone rather than as an industrial mineral, because of its bright colors. Fluorite occurs in epithermal copper-lead-barite veins and as a gangue mineral in tin-tungsten veins in the south. Large fluorite veins occur in the granite mountain range in the west, where outcrops such as the "Gemstone Hill" can be found, with colors ranging from green, blue, purple,

[illegible] problems.[illegible]

Thailand's fluorite industry began to flourish in the early 1960's, but since energy prices rose sharply in 1973, the Thai fluorite prices have barely kept up with increased costs of production and transport, forcing less efficient operations to close.[27] Most fluorite production has been for export, primarily to Japan, but Japan's demand for fluorite has been declining. In order to offset this, Thailand has obtained new markets for its fluorspar, and the U. S. S. R. is now Thailand's largest customer of both metallurgical-grade and acid-grade fluorite. Thailand ranks eighth in the world in terms of fluorite production, but must import fluorine chemicals because of a lack of downstream chemical industries in the country. Thailand is attempting to attract foreign firms to build a chemical complex to produce hydrofluoric acid and fluorine chemicals, but unless the Thai Government removes the minimum production quota clause in its demands, it is unlikely that an investor will become interested.[16] Figure 5-25 shows production and export patterns of fluorspar in Thailand.

GYPSUM

Small deposits of gypsum occur in northern Thailand, but are usually contaminated with clay, raising the production costs. Production levels of gypsum have made it sixth in mineral commodity importance, but export markets have become unstable with the fairly recent development of synthetic gypsum. Domestic construction in the 1970's has been largely

responsible for the success in the gypsum industry. Figure 5-26 shows the production and export patterns of gypsum in Thailand.

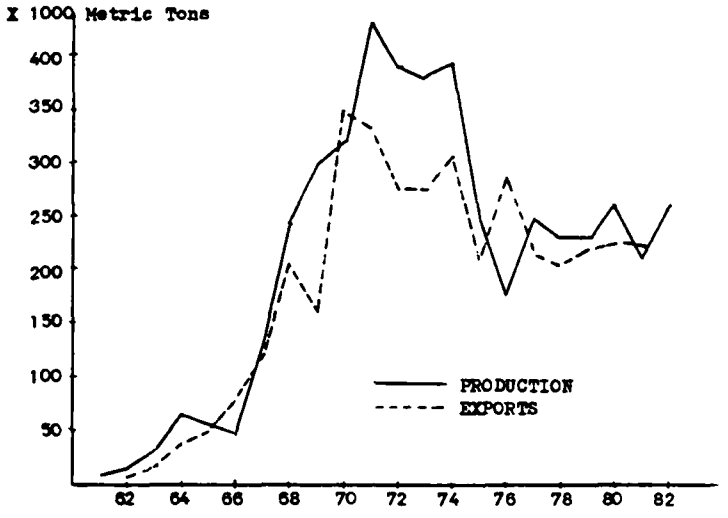



Figure 5-25: Annual Production and Exports of Fluorspar in Thailand, 1961-1982.
Source: Minerals Yearbook, U. S. Bureau of Mines.

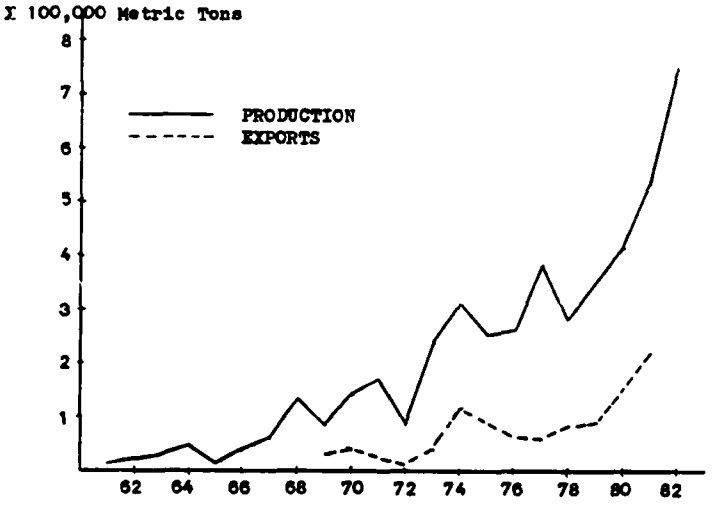



Figure 5-26: Annual Production and Exports of Gypsum in Thailand, 1961-1982.
Source: Minerals Yearbook, U. S. Bureau of Mines.

Thailand has been almost totally dependent upon imports for fertilizer since 1968 when the country began importing it for its agricultural industry. In an attempt to produce nitrogenous fertilizer domestically, the Thai Government was negotiating with a Scandinavian consortium to construct a $590 million plant but negotiations were terminated in 1982 because the two sides could not agree on Thai natural gas prices, rate of return on the consortium's investment, and the price of the nitrogen fertilizer when selling it to the Thai Government.[16]

Thailand produces an insignificant amount of phosphorous fertilizer from its domestic phosphate rock. Much of the rock is 30 percent $P_2O_5$ and is used directly as fertilizer after crushing and pulverization.[16] Thailand has reportedly opened the world's first dry phosphate fertilizer production facility, which treats the phosphate with gaseous sulfur trioxide. The operating costs are said to be 30 percent lower and capital is 60 percent less than in a conventional phosphate plant. Figure 5-27 shows production, imports, and exports of fertilizer in Thailand.

Potash is expected to become the second most important mineral in Thailand, after tin. In 1977, a Canadian research and exploration firm received a contract to study rock salt, soda ash, and potash deposits in Thailand for development.[6] The study concluded that Thailand may have the world's largest potash deposit. In 1979, the Thai Government appointed a committee to investigate these deposits in the northeast part of

the country.[7] Now potash exploitation in Thailand is closer to reality. A joint venture is going on between Duval Corp. of the United States, CRA Exploration of Australia, and Siam Cement Co. of Thailand. The area needing development covers over 3500 square kilometers and each concessionaire will be allowed to produce 2 million tons of potash per year.[32]

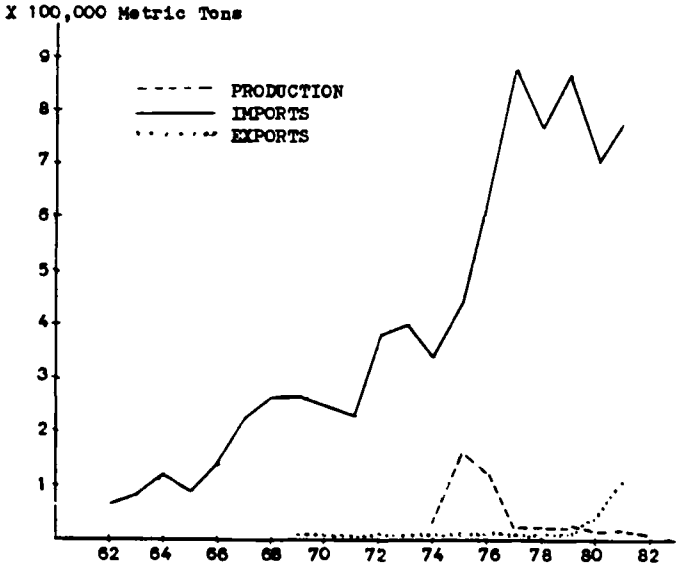



**Figure 5-27:** Annual Production, Imports, and Exports of Fertilizer in Thailand, 1961-1982.
Source: Minerals Yearbook, U. S. Bureau of Mines.

DIAMONDS, PRECIOUS, AND SEMI-PRECIOUS STONES

Gemstones such as saphires, deep red rubies, topaz, and zircons, associated with pegmatities and schists, are mined in shallow pits using screening and panning. These gemstones are principally located in the southeast of Thailand.[4] Thailand does not publish any production statistics of gemstones, but trade data reveals that the country imports a considerable

amount, and exports even larger quantities, reaching over a billion carats in 1981.[27] Figure 5-28 shows the import and export patterns of gemstones in Thailand.

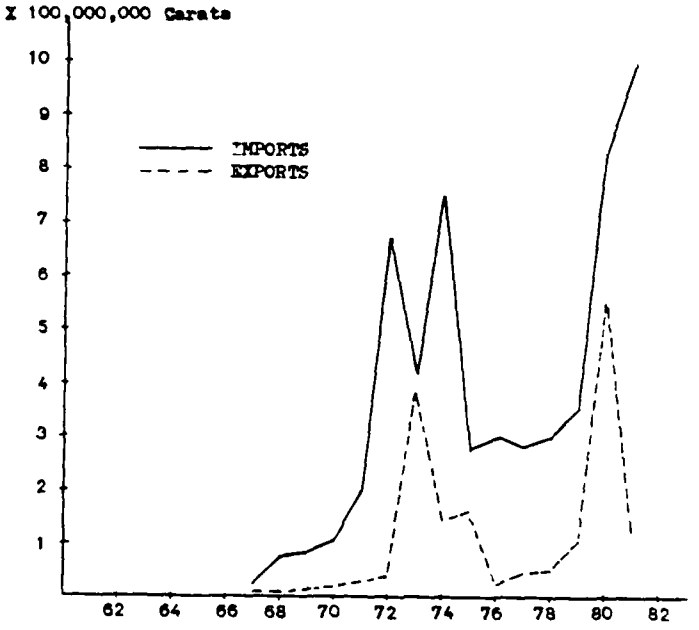



**Figure 5-28:** **Annual Imports and Exports of Diamonds and Precious and Semi-precious Stones in Thailand, 1961-1982.**
**Source:** Minerals Yearbook, U. S. Bureau of Mines.

SALT

Thailand has been successful in producing sufficient quantities of salt from seawater evaporation, allowing an average of 100,000 tons of salt to be exported per year since 1963. The salt situation in Thailand will change considerably by 1986. In 1978, a deposit in northeast Thailand was discovered that could be the world's largest rock salt deposit, containing over 4.8 billion tons of rock salt and soda ash. Thailand's Association of Southeast Asian Nations, consisting of Thailand,

the Republic of the Philippines, Malaysia, Singapore, and Indonesia, has prepared and approved plans for a $380 million rock salt and soda ash project to be started soon. The plan calls for a 600,000 ton-per-year rock salt plant in the northeast and a 400,000 ton-per-year soda ash plant in the south. Thailand's delivered cost of natural gas and ammonia will be a critical factor in this project.[27] Figure 5-29 shows the production and export patterns of salt in Thailand.

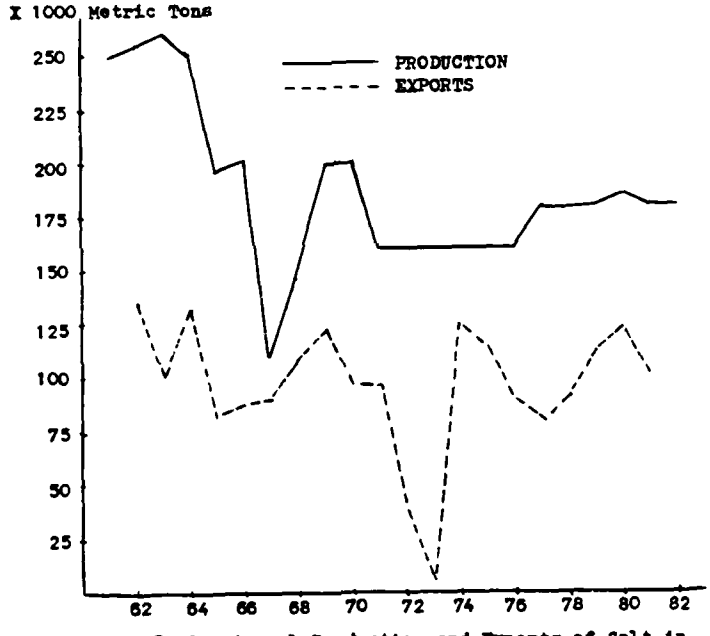



**Figure 5-29: Annual Production and Exports of Salt in Thailand, 1961-1982.**
**Source: Minerals Yearbook, U. S. Bureau of Mines.**

SULFUR

Thailand is 100 percent import-dependent for sulfur supplies, and procures them from Canada, the Republic of Korea, China, and Japan. Figure 5-30 shows the import trends of

sulfur in Thailand.

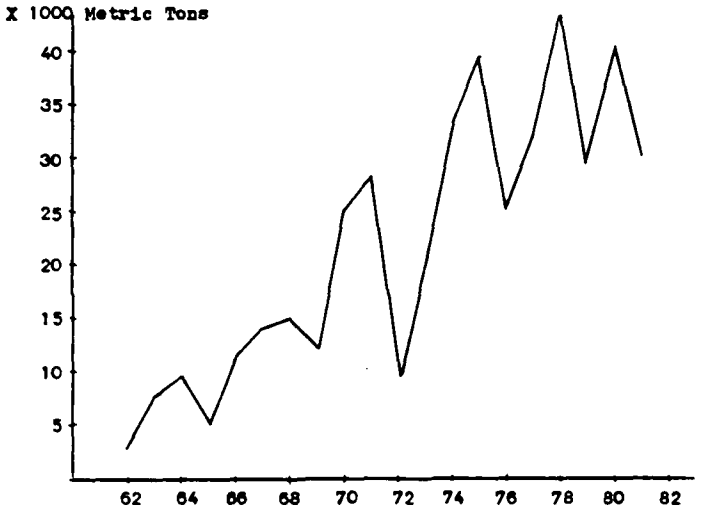



Figure 5-30: Annual Imports of Sulfur in Thailand, 1961-1982.
Source: Minerals Yearbook, U. S. Bureau of Mines.

TALC

Thailand produces modest quantities of talc, primarily for export as shown in Figure 5-31. Most of the talc exports are destined for the Republic of Korea and China.

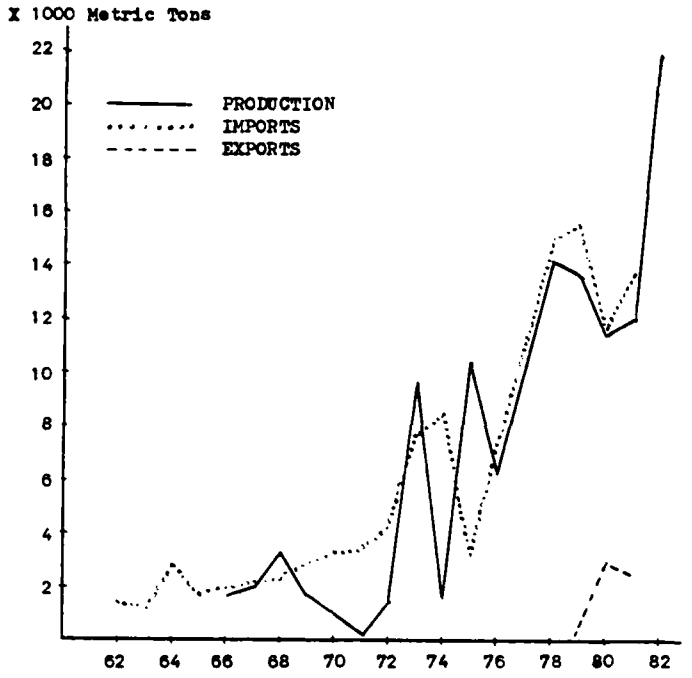



Figure 5-31: Annual Production, Imports, and Exports of Talc in Thailand, 1961-1982.
Source: Minerals Yearbook, U. S. Bureau of Mines.

## GOVERNMENT POLICY STRATEGIES

The government of Thailand has been plagued with uncertainty and numerous coups and overthrows. In 1976, the government was overthrown four times, and the country was placed under martial law. The following three years saw two attempted coups and one successful attempt. In 1979, political elections were held, but voter turnout was so poor that the election was later viewed as a silent protest by the general public.[3]

In regards to mineral policy, the Thai Government has had rigid, unbending policies, many times leading to discouraging foreign investment. The previous governments have a history of expropriations and cancelling concessions as they did

with tin concessions held by Union Carbide Corporation and Royal Dutch Petroleum (Shell) in 1974.[27] Negotiations for new mineral and industrial ventures in Thailand often terminate with no agreements because of strict demands concerning production targets being made by the Thai Government. Specifically, negotiations for zinc, lead, and fertilizer plants have been terminated by foreign venture partners out of fear of fines similar to those levied against Union Oil Co.[27]

Recently, the Thai Government embarked on a new program that should attract foreign investment and joint ventures. A newly established Board of Investment implements government policies concerning investments and determines which companies qualify for generous privileges as promoted companies. Foreign investment is not limited, except in a very few designated activities where it is limited to 49 percent equity. Activities that can be 100 percent foreign-owned include agriculture, livestock, fishing, mining, manufacturing, and services.

The government offers the following guarantees and concessions: guarantees against nationalization, competition from new state enterprises, monopolization of sales of products, price controls and export restrictions, and duty-free imports by government agencies or state enterprises. Protection measures have been offered as follows: (1) a surcharge on foreign products at a rate not exceeding 50 percent of the costs of insurance and freight value for a period of not longer than one year at a time; (2) a ban on imports of competitive products; and (3) authority in the hands of the Prime Minister,

acting as chairman of the Board of Investment, to order any actions or tax relief measures for the benefit of promoted projects. The Thai Government has also granted permission for promoted firms to bring in foreign nationals to undertake investment feasibility studies, foreign technicians and experts to work on promoted activities, and to take or remitt foreign currency abroad.[35]

In addition to investment guarantees, the Thai Government has offered the following tax incentives to foreign investors: (1) duties and business taxes on imported machinery may be exempted or reduced by 50 percent; (2) duties and business taxes levied on imported raw materials and components may be reduced up to 90 percent for a year at a time; (3) corporate income taxes may be exempted for up to 3-8 years, with losses carried forward and deducted as expenses for up to five years; (4) exemption of up to 5 years on withholding tax on goodwill payments, royalties, or fees remitted abroad; and (5) dividends derived from promoted firms are excluded from taxable income during the income tax holiday.[35]

The Thai Government has additional tax incentives for enterprises located in investment promotion zones. These incentives include: (1) a maximum reduction of 90 percent on business taxes on the sale of products for up to 5 years; (2) a 50 percent reduction of corporate income tax for 5 years after the termination of the normal income tax holiday from the date earnings began; (3) an allowance of double the cost of transportation, electricity, and water for deduction from

corporate taxable income of up to 25 percent of the investment in the cost of infrastructural facilities for 10 years from the date earnings began.[35]

For export-oriented industries and investments, the Thai Government has added the following additional incentives: (1) exemption from import duties and business taxes on re-export items; (2) exemption on export and business taxes; and (3) allowance to deduct from the corporate taxable income the equivalent of 5 percent of an increase in income derived from exports over the previous year, excluding cost of insurance and transportation.[36]

Major development plans in Thailand include upgrading the telecommunications system, constructing a power transmission station at Mae Moh, building a methanol plant, expansion of port facilities at Song Khla and Phuket, and constructing another international airport at Nong Ngu Hao.[37] The government also plans to build better, smaller-sized ports to transport goods from Bangkok to other cities by ship. This is an important project because of the frequent damage on Thailand's railways by Communist-rebel saboteurs.[15]

## RELATIONS WITH THE UNITED STATES

Official U. S. - Thai relations date from 1883 when the two countries signed the Treaty of Amity and Commerce, the first U. S. treaty with an Asian country. In the post World War II era, the United States and Thailand have developed close relations in many fields, as reflected in several bilateral

treaties and both countries' participation in many multilateral activities and agreements. In 1966, the Treaty of Amity and Economic Relations was signed, and other agreements since have covered air transport, cotton textiles exports to the U. S., investment guarantees, and military and economic assistance. Numerous programs are ongoing in Thailand, including the U. S. Peace Corps and a U. S. Military Advisory Group. With the termination of hostilities in 1975, and in recognition of the increasing ability of Thailand to purchase arms with its own resources, grant military aid was gradually decreased and was completely eliminated in 1978.[2]

## TAXES IN THAILAND

The Thai Government currently offers numerous tax incentives to its favored industries, but sudden, unexpected changes in Thailand's tax laws have discouraged many would-be investors and developers. Because of the history of political instability in Thailand, tax treatment could change with little or no warning. In 1983, the Thai Government added retroactive tax measures to many corporations, increasing accounting costs and causing many hard feelings. Executives of corporations that ended up owing large tax bills were not allowed to leave the country for any reason until their back taxes were paid.[36]

The present mineral tax policy includes a royalty to the government of 12.5 percent of gross sales and corporate income taxes amounting to 50 percent of net profit before applying incentives.[32]

## POLICY ANALYSIS CONSIDERATIONS

In the next ten years, Thailand will face difficult problems in managing its resources. Population will grow and the nation's once abundant resources will likely continue deteriorating. The income gap between urban and rural inhabitants is wide and will get worse. An overhaul of the government's administrative machinery is needed. Weak political parties and a domineering bureaucracy must be contended with.[38]

Thailand will continue striving for greater U. S. trade and investment. The government expects that more investment will boost the nation's annual growth rate to more than the 5 percent it is presently experiencing. Thailand's growing need for capital has forced the present government to abandon any type of protectionism and requires the government to support a free trade policy. Thailand's greatest asset in recent years is the oil and natural gas discoveries, with on-and offshore natural gas reserves estimated to be more than 15 trillion cubic feet.[39]

The world recession has caused a number of potential investors to withdraw from Thailand. Presently Japan and the United States are the largest investors, each spending about $28 million per year since 1980. Abrupt, sudden changes in Thailand's government several times in the past few years has led to political instability and a lack of confidence by many investors. To stimulate interest, the United States sponsored a large industrial exhibit in 1981, vith over 80 U. S. companies displaying their products, which included solar energy

units, security devices, construction equipment, and computer systems.[40]

A heavy industrial area has been designated in the eastern rim of the Gulf of Thailand for soda ash, sponge iron, fertilizer, and steel plants. This designation was sought to improve the investment climate and reduce lead times in future projects.[40] The expansion and development of the eastern seaboard presents an excellent potential for U. S. investors. Infrastructure expansions are planned, including a deepwater port to be built in Laem Chabang by 1987. Major industrial projects in this area include a gas separation plant, a chemical fertilizer plant, a vinyl chloride monomer plant, a petrochemical complex, a soda ash plant, and another methanol project. Light industries will include food processing, textiles, electronics, and support industries and facilities. Other projects include an ethylene cracking plant to make 250,000 tons of ethylene and 62,000 tons of propylene per year, a million cubic meter oil storage facility, capable of docking and loading and offloading 200,000 dead-weight-tonnage tankers, increasing the Bangkok Oil Refinery capacity from 65,000 barrels per day to 90,000 barrels per day, and to shift production more toward benzine and diesel fuels rather than bunker oil, and the construction of a 100,000 barrel-per-day oil refinery in the Krabi Province in southern Thailand.[17]

Thailand has emerged from the most recent world recession in an extremely favorable position. Having an abundant reserve base, this country is a primary source of many minerals

to other Asian and to European countries. Thailand is basically self-supporting and has a promising future, provided its political stability does not deteriorate as it has so often in the past.

REFERENCES

1 Europa Publications Limited, The Europa Yearbook 1983, A World Survey, Vol. 2 (London, England: The Stanhope Press, 1983).

2 Frederica M. Bunge, THAILAND: A Country Study (Washington, D. C.: Foreign Area Studies, the American University, 1981).

3 U. S. State Department, et al., Countries of the World and Their Leaders Yearbook 1984 (Detroit: Gale Research Company, 1984).

4 Glen F. Brown, et al., Geological Survey Bulletin No. 984 (Washington, D. C.: U. S. Government Printing Office, 1951).

5 George O. Argall, Jr., "Offshore Tin Dredging in Thailand by Divers, Buckets, and Suction Dredges," World Mining, April 1977.

6 Anon., "What's Going on in World Mining," World Mining, 1972-1984.

7 Anon., "Worldwide Survey," World Mining, 1972-1984.

8 Anon., "Excellent Growth Record During World Slump Suggests a Bright Future for the Economy and Import Market," Business America, July 11, 1983.

9 Anon., "Thai Inflation Rate," Wall Street Journal, December 13, 1983, Sec. 2, p. 38e.

10 Anon., "Thailand Will Allow Fewer Tax Waivers on Short-Term Loans," Wall Street Journal, June 23, 1983, Sec. 2, p. 36e.

11 Peter Truell, "South Korea Seeking $500 Million, Thailand Asks for $85 Million Loan," Wall Street Journal, March 6, 1984, Sec. 2, p. 38e.

12 Anon., "IMF Approves Loan Totalling $963.7 Million," Wall Street Journal, June 8, 1981, Sec. 2, p. 31e.

13 Anon., "World Bank Lends $150 Million to Thailand," Wall Street Journal, March 5, 1982, Sec. 2, p. 34e.

14 Sheila Daniel, "Thailand Counting on Offshore Gas Finds to Boost Economy, Ease Trade Deficits," The Oil Daily, May 18, 1982, p. 6.

15 U. S. Department of the Interior, Bureau of Mines, "The Mineral Industry of Thailand," by Gordon L. Kinney, Minerals Yearbook (Washington, D. C.: U. S. Government Printing Office, 1983).

17 Anon., "Thailand: Excellent Growth Record During World Slump Suggests a Bright Future for the Economy and Import Markets," Business America, July 11, 1983.

18 Anon., "Thailand's Trade Deficit," Wall Street Journal, March 6, 1984, Sec. 2, p. 39e.

19 Anon., "Word Due on Thailand LNG Project Exports," Oil and Gas Journal, July 26, 1982.

20 Anon., "Two Firms Pay Thai Oil Royalties," The Oil Daily, July 25, 1983.

21 Anon., "Thailand Producing Crude Oil," Journal of Commerce, December 22, 1982.

22 U. S. Department of the Interior, Bureau of Mines, "The Mineral Industry of Thailand," by Gordon L. Kinney, Minerals Yearbook (Washington, D. C.: U. S. Government Printing Office, 1981).

23 Anon., "Thai's Accept Findings of Lower Gas Reserves at Field Run by UNOCAL," Wall Street Journal, December 15, 1983, Sec. 2, p. 35e.

24 Prakong Polahan, Thailand Department of Mineral Resources, Bangkok, Thailand, "Shell's Oil Development, ESSO's Gas Finds - Both Onshore - Highlight Action in Thailand," Oil and Gas Journal, May 16, 1983.

25 Anon., "Union to Boost Thai Gas Output," The Oil Daily, July 11, 1983.

26 U. S. Department of the Interior, Bureau of Mines, "The Mineral Industry of Thailand," by Gordon L. Kinney, Minerals Yearbook (Washington, D. C.: U. S. Government Printing Office, 1978-79).

27 U. S. Department of the Interior, Bureau of Mines, "The Mineral Industry of Thailand," by Gordon L. Kinney, Minerals Yearbook (Washington, D. C.: U. S. Government Printing Office, 1963-1982).

28 Paul F. Scholla, et al., Tungsten in Thailand (Bangkok: Paul F. Scholla and Associates, July 1977).

29 Paul F. Scholla, et al., Tin Deposits in Thailand (Bangkok: Paul F. Scholla and Associates, January 1978).

30 Anon., "Tin Mining Today - Placer and Lode Mining and Beneficiation," World Mining, February 1977.

31 Anon., "Venture in Thailand Plans Zinc Smelter Costing $142 Million," Wall Street Journal, October 27, 1981, Sec. 2, p. 36e.

32 Keith Lorenz, "Thailand Launches Vital Five-Year Plan," The Journal of Commerce, July 27, 1982.

33 Anon., "Key Rubber Producers to Restrict Supplies in Bid to Boost Price," Wall Street Journal, May 24, 1982, Sec. 2, p. 25e.

34 Raphael Pura, "Asian Rubber Producers Apparently Fail to Reach Accord on Plan to Curb Supplies," Wall Street Journal, September 10, 1982, Sec. 2, p. 42e.

35 Thai Board of Investment, "THAILAND: An Open Door for Investors," Nation's Business, September 1983.

36 Anon., "Thai Taxes on Tax Rebates Upset Foreign Firms," Wall Street Journal, June 29, 1983, Sec. 2, p. 38e.

37 Linda Drocker, "Thailand: Sound Economy Poised to Participate in Any Recovery," Business America, February 21, 1983.

38 Ameret Sila-On, "Thai Population Swells as Reserves Shrink," Wall Street Journal, October 3, 1983, Sec. 2, p. 31e.

39 Stanley Mantrop, "Thai's Open Campaign for More U. S. Investors," Journal of Commerce, May 17, 1983.

40 Keith Lorenz, "Thailand Seeks Industrial Projects to Offset Drop in Foreign Investment," Journal of Commerce, July 2, 1981.

# CHAPTER SIX:

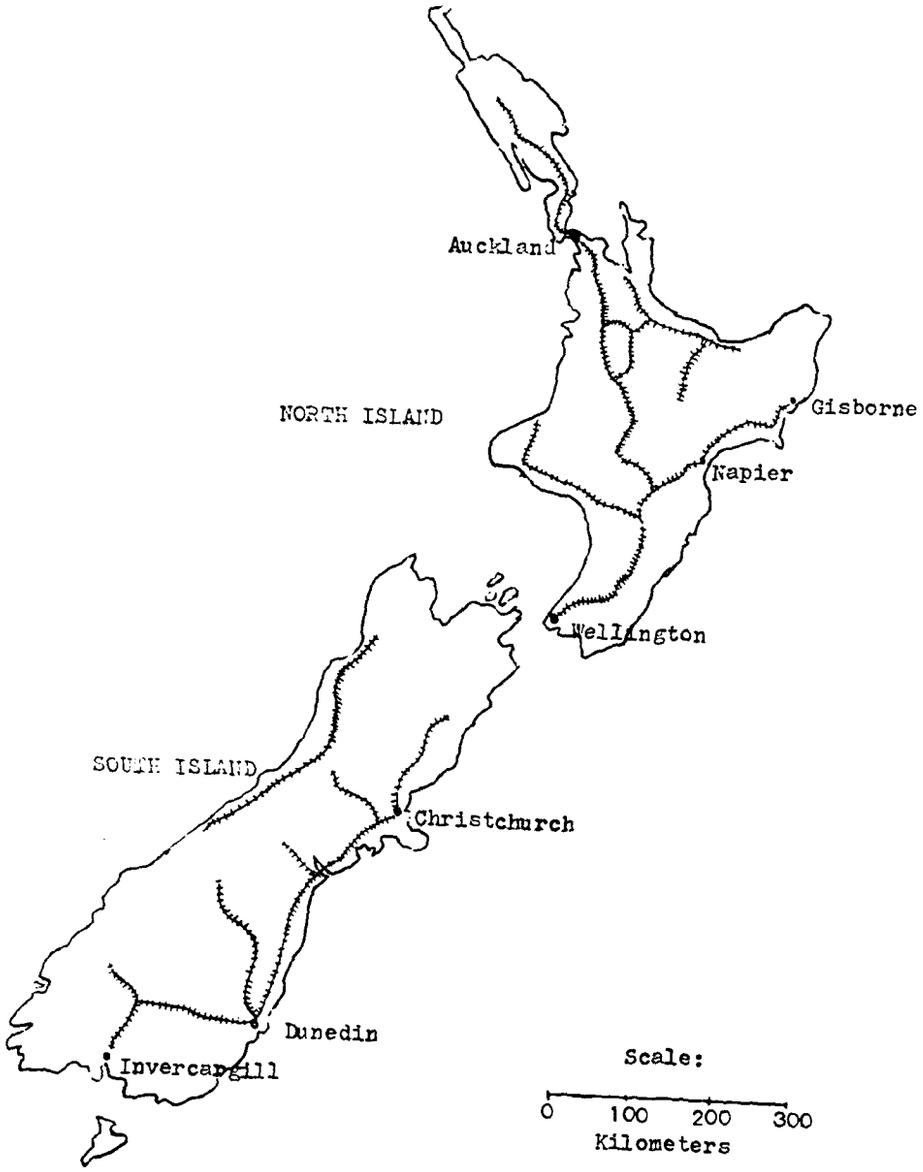
# THE

# MINERAL INDUSTRY

# OF

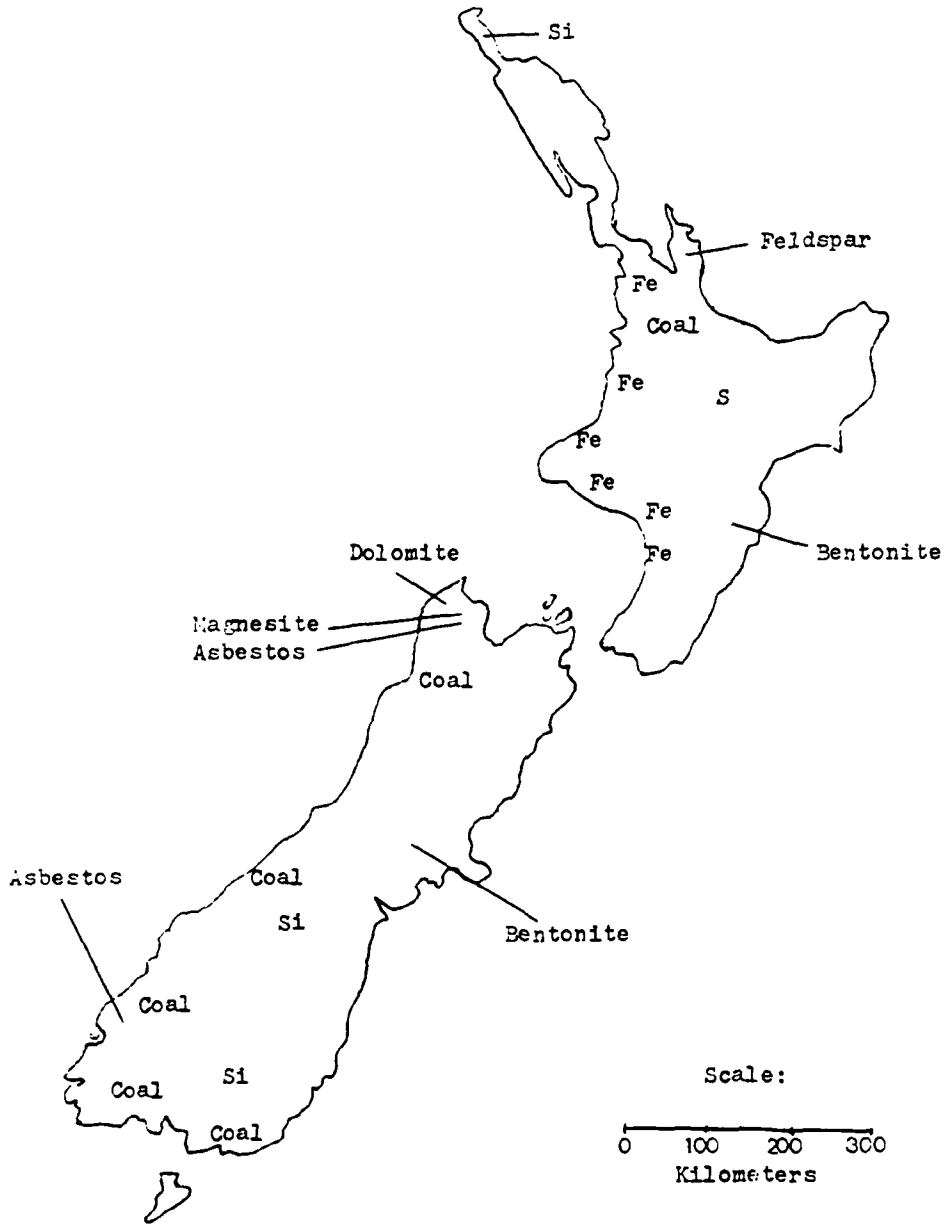
# NEW ZEALAND

Map 8-1. Geographic Map of New Zealand




Source: New Cosmopolitan World Atlas, Rand McNally and Company, 1965.

Map 6-2. Mineral Distribution in New Zealand




Source: New Cosmopolitan World Atlas, Rand McNally and Company, 1965. New Zealand Official Yearbook 1983, Department of Statistics, Wellington, 1983.

## INTRODUCTION

New Zealand is in the southwest section of the Pacific Ocean, approximately 1000 miles southeast of Australia. This island nation is made up of two islands, containing a total landmass of 103,886 square miles, about the size of Colorado. The population in 1981 was 3.176 million with an annual growth rate of 1.2 percent.[1] 73 percent of all New Zealanders live on North Island, and the remaining 27 percent live on South Island. The largest city, Auckland, supports a population of 840,000 inhabitants, and the other major cities are Canterbury, population 337,000; and Wellington, population 322,000.[2]

New Zealand's mining and extractive industries do not represent a significant portion of the national economy. In terms of gross national product, this sector represented only 0.7 percent in 1981.[2] From a labor standpoint, it represents only 0.4 percent of the total labor force. See Table 6-1 for New Zealand's labor distribution.[2]

**Table 6-1. Distribution of Labor in New Zealand, 1981**

| Industrial Sector | Percentage of Total Labor Force |
|---|---|
| Agriculture | 10.5 |
| Forestry | 0.7 |
| Mining/Quarrying | 0.4 |
| Manufacturing | 24.0 |
| Utilities | 1.3 |
| Construction | 6.9 |
| Trade/Retailers | 18.2 |
| Communications | 2.7 |
| Transportation | 6.0 |
| Finance | 7.1 |
| Services/Government | 22.2 |

Source: New Zealand Official Yearbook 1983, Department of Statistics, Wellington.

Labor disputes are rare and usually short in duration. Unemployment in New Zealand has traditionally been extremely low and was considered non-existent until in the 1980's. In 1981, it was fixed at 4.8 percent and rising, primarily due to a market slump in pastoral products.[2] New Zealanders maintain a very high standard of living, with a per capita gross domestic product of $10,549 per year, with agriculture being the base of this high standard of living. New Zealand is the world's largest exporter of lamb, mutton, and dairy products, and ranks second to Australia in wool exports.[5]

Industry in New Zealand has been slowly developing, and with the present long-term stagnation in farm product markets and prices, economic growth in the country has been slow. Until after World War II, the objectives of the New Zealand industrial base was to satisfy domestic consumption, but more recently, the growing need for more foreign exchange and increasing trade deficits have mandated a more export-oriented industrial base. Most recent emphasis has been on aluminum production, steel smelting, natural gas developments, liquid natural gas distribution, and synthetic petroleum.

## GEOLOGY

The islands of New Zealand are part of the unstable circum-Pacific Mobile Belt, placing the country in a region where volcanos are active and the Earth's crust is buckling and breaking at a geologically rapid rate. Landmasses that have been uplifted have been subject to erosion, causing thick

accumulations of sandstones, mudstones, greywackes, and conglomerates, both on land and off shore. Shells and skeletons of many sea creatures have accumulated around the islands to form thick layers of limestone.[2]

The Economic Geology Section of the New Zealand Geological Survey is responsible for the investigation of potentially valuable mineral deposits in the country. The geology of many mineral deposits has been investigated, but significant progress began only within the past 15 years. The geology of specific minerals is discussed in the mineral commodity analysis section of this chapter.

## RESOURCE/RESERVE BASE

The principal natural resources in New Zealand are natural gas, iron sand, coal, and timber. Other minerals of local importance are silver, aluminum, gold, copper, mercury, molybdenum, nickel, lead, titanium, uranium, tungsten, zinc, bentonite, dolomite, asbestos, glass sands, and sulfur.[2] Although a few statistics are available concerning the mineral reserves in New Zealand, only coal and natural gas information is published, mainly to attract potential investors. Resource and reserve information is discussed, when available, in the mineral commodity analysis section of this chapter.

## GROSS NATIONAL PRODUCT

New Zealand has traditionally been considered to have a stable economy, but in recent years, the government has been striving to resolve serious problems: high inflation, a severe

balance of payments deficit, labor unrest, an outflow of skilled workers, and budget deficits.[1] On the positive side, the country has been able to obtain more favorable trade balances in the past few years, and to solve some of the marketing problems in the agricultural sector, the government has contracted with several countries to barter beef and mutton for imported commodities. The most successful attempt is with Iran, where oil is exported to New Zealand and payment is made with shipments of lamb and mutton to Iran.[6]

Table 6-2 shows the steady but relatively slow growth in New Zealand's gross national product since 1963. This country's economy was based too heavily on pastoral production and was severely affected by the Arab oil embargos of the 1970's.

Presently, New Zealand is suffering from the most recent worldwide recession and side affects of the Iran-Iraq War. Wool prices have gone so low that the government is buying it and stockpiling it. Only 60 percent of lamb and sheep slaughtered in 1982 had a market. The country has begun to see the ill-effects of being totally dependent upon a small number of agricultural products for an economic base.[7] The New Zealand Government maintains a "think big" attitude concerning fixing the ailing economy. A $1 billion synthetic fuel plant in a joint venture with Mobil Oil Corp. is expected to reduce oil imports and increase domestic production of gasoline to such an extent that it will correct the country's economic problems. Other ongoing ventures to diversify and stimulate the economy

include a $500 million oil refinery expansion, a $200 million addition of a potline at the $1 billion Comalco Ltd. aluminum smelter on South Island, an ammonia/urea plant that will use some of the offshore natural gas, a second aluminum smelter, and a $200 million methanol plant.[7]

Table 6-2. New Zealand's Gross National Product (Millions of Dollars)

| Year | GNP | Minerals and Mining | Percentage of GNP |
|---|---|---|---|
| 1963 | $3,768 | 56.53 | 1.5 |
| 1964 | 4,448 | 59.0 | 1.5 |
| 1965 | 4,884 | 65.78 | 1.3 |
| 1966 | 5,348 | 69.52 | 1.3 |
| 1967 | 5,889 | 58.89 | 1.0 |
| 1968 | 4,659 | 50.99 | 1.1 |
| 1969 | 4,841 | 53.25 | 1.1 |
| 1970 | 5,014 | 55.15 | 1.1 |
| 1971 | 6,992 | 76.91 | 1.1 |
| 1972 | 8,509 | 93.6 | 1.1 |
| 1973 | 10,077 | 131.0 | 1.3 |
| 1974 | 12,286 | 172.0 | 1.4 |
| 1975 | 10,051 | 176.0 | 1.7 |
| 1976 | 16,200 | 160.0 | 1.0 |
| 1977 | 15,419 | 139.7 | 0.9 |
| 1978 | 16,700 | 150.0 | 0.9 |
| 1979 | 17,100 | 159.0 | 0.9 |
| 1980 | 17,300 | 160.2 | 0.8 |
| 1981 | 23,400 | 162.0 | 0.7 |

Source: Minerals Yearbook, U. S. Bureau of Mines, 1963-1982.

## NATIONAL DEBT

In the beginning of the 1970's, New Zealand's population was among the most affluent in the western world, and employment problems were non-existent. In 1973, the oil shock damaged the economy, and since then, prices of wool, lamb, beef, butter, cheese, casein, and milk powder haven't been able to keep pace with rising costs to support the country's

economy.[8] Now unemployment is growing, reaching nearly 10 percent in December 1982, and New Zealand is worried about the balance of payments problem. The declining prices of New Zealand's pastoral products has created a high level of national borrowing.

In December 1982, the government debt was $4.69 billion, equalling 22.7 percent of the gross national product. The total public debt, including private debts equalled over $7.26 billion, and when all debts were combined, the national debt of New Zealand was 157 percent of annual exports.[9] Despite the debt situation in New Zealand, projects in the country are being planned and will have to be built using borrowed capital or foreign joint venture investments. Loans of vast amounts of money are presently being considered by banking consortiums from Hong Kong, Great Britain, Japan, and New Zealand.[9]

## ENERGY MIX

After being devastated financially by the Arab oil price increases, the New Zealand Government adopted development programs to reduce the country's dependence on foreign oil imports. New Zealand has ample reserves of natural gas and coal, and thus far, limited reserves of oil, all of which when combined, gives New Zealand the energy resources to greatly reduce oil imports. New Zealand's energy is used in transportation (40 %), industry and commerce (28 %), households (12 %), industrial development projects (11 %), and international

transportation (9 %). In 1981, imported crude oil and liquid natural gas accounted for over 50 percent of all energy requirements. By 1991, the government wants this figure reduced to 35 percent. In 1981, natural gas supplied less than 5 percent of the nation's total energy, and by 1991, it is planned to provide over 14 percent.[11] The government's plans for natural gas development is discussed below.

New Zealand has an extensive hydropower and geothermal capacity which have not been developed to their full potential. Table 6-3 shows the present sources of electricity generation in New Zealand and the projected distribution in 1991.

**Table 6-3. New Zealand's Electrical Energy Sources**

| Energy Source | Percent of Total (1981) | Planned (1991) |
|---|---|---|
| Hydropower | 87 | 72 |
| Coal | 2 | 8 |
| Natural Gas | 7 | 14 |
| Geothermal | 4 | 6 |

**Source:** Oil and Gas Journal, **February 8, 1982.**

## WATER AVAILABILITY

Agriculture in New Zealand uses 60 percent of the country's annual water consumption, and the remaining 40 percent is approximately evenly divided between industrial and domestic uses. Approximately 87 percent of water used in the country is supplied by public water supply systems, with industry obtaining about two-thirds of its water from its own independent sources.[2] In 1967, the government established the Natural Water and Soil Conservation Organization to manage the

country's water supplies. This organization requires permits from any activity that initiates and/or increases water consumption, except for household uses.[2] Water resources are not expected to be a problem in the future in New Zealand.

## ENVIRONMENTAL CONSIDERATIONS

Public concern for the environment in New Zealand has led to an increased awareness of pollution problems. Organizations have responded by involving the public in the decision-making processes and by amending legislation to provide the appropriate controls. New Zealand established a Nature Conservation Council in 1962, and since then, various environmental protection organizations protect different parts of the physical environment of the country. Areas in which powerful environmental groups are involved include soil erosion, farm run-off, industrial waste, domestic sewage, urban solid-waste disposal, and mine restoration.[2] New Zealand's geographic location is very conducive to air dispersal, and the country does not have an air pollution problem.[2]

In the past, mining and quarrying has left the landscape so scarred that they appeared to produce only perpetual devastation. Now the Minister of Energy can impose conditions for mining licensing that he thinks are necessary to ensure proper restoration, prior to granting a license. Local governments also have the power to enforce environmental quality. The most pressing problems facing New Zealand's environment at present are the erosion of soil and the over-exploitation

of fisheries and seafood.[2]

## INFRASTRUCTURE

Transport in New Zealand is complicated by the geographic configuration of the country, the separation into two main islands, the location of the main urban areas, the number and situation of the main ports, the seasonal nature of much of the production, and the large proportion of one-way loading in the internal transport system. In its overseas trade, the country is still largely dependent upon overseas shipping companies to carry its exports to distant markets.

Being a nation that depends upon imports and exports, New Zealand has had to adapt to technological changes which extend through the entire transport system. Container ports are a necessity, but because of New Zealand's debt situation, they cannot be built. New Zealand has numerous small towns along its coasts, but many of their ports can only accomodate small fishing vessels. Table 6-4 lists the significant ports in the country.

**Table 6-4. Port Cities in New Zealand**

| Major Ports | | Minor Ports | |
|---|---|---|---|
| Auckland | Christchurch | Whangarei | Palmerston North |
| Wellington | Dunedin | Gisborne | Invercargill |
| | | Napier | Lyttleton |
| | | Wanganui | Port Chalmers |

**Source:** The International Atlas, Rand McNally, 1979.

The New Zealand Railways Corporation is responsible for a network of railways extending over 4400 kilometers, connecting

almost every major population center in the country. Recent years have seen notable progress in the development of the railway system and cargo carrying capacity, including ultra-modern diesel and electric locomotives, transistorized traffic control, and computerized monitoring of freight cars and other equipment.[2] The most recent development is a $134 million rail electrification project on the main rail line on North Island, to be completed by 1987.[10]

Capital investment in New Zealand's road system exceeds that of all other transportation spending. There are more than 96,000 kilometers of road and over 1.8 million motor vehicles in the country.

New Zealand ranks high among world nations in terms of air transport capability relative to its population size. The state-owned Air New Zealand (domestic) and the wholly-owned subsidiary Safe Air Ltd., the nation's air freight carrier, are the major domestic air service operators in the country. Table 6-5 lists the airports in New Zealand.

**Table 6-5. Airports in New Zealand**

| | | |
|---|---|---|
| **Wellington*** | **Palmerston North** | **Blenheim** |
| **Auckland*** | **Invercargill** | **Napier** |
| **Dunedin*** | **Christchurch** | **Cambridge** |

***Major International Airports.**

**Source:** The Times Atlas of the World, Houghton Mifflin Company, 1978.

## MINING, PROCESSING, AND REFINING

Traditionally, the New Zealand Government has not placed much emphasis on downstream processing of minerals prior to export, but recently with the massive trade deficits, further processing of minerals has begun to be viewed as one way to obtain more foreign exchange.

New Zealand mines minerals using several techniques. Beach sands are dredged and magnetically separated. Precious metals are also dredged from river deposits as deep as 130 feet. Lode deposits and massive-sulfide lenses containing copper, lead, zinc, gold, and silver have been mined in open pits, and small amounts of manganese-nickel nodules have been mined from the surrounding sea floor, but it was not an economically profitable operation.[1] Nodule mining in New Zealand has been suspended.

Most minerals are exported as ore and concentrate, but with an energy surplus in the country, aluminum smelting capacities are expected to increase. Iron beach sands are exported as concentrates, but sufficient quantities are used in blast furnaces to support the domestic steel industry. The mining methods and processing of specific minerals are discussed in more detail in the mineral commodity analysis section of this chapter.

## INTERNATIONAL TRADE

New Zealand has always been heavily dependent upon overseas trade for its development and progress. Today the

Value of New Zealand's overseas trade as a proportion of the gross national product is among the highest in the world. In the early years of New Zealand's colonization, basic foodstuffs dominated the trade industry. Now, New Zealand's exports are wool, lamb, butter, mutton, beef, veal, other dairy products, wood pulp, paper, forestry products, and manufactured goods. Commodities imported into New Zealand include food and live animals, beverages and tobacco, crude raw materials, minerals and mineral fuels, lubricants, animal and vegetable oils, chemicals and related products, machinery and transport equipment, and manufactured goods.[2] The principal trading partners are Australia, the European Economic Community, the United States, and Japan, but New Zealand also trades with the U. S. S. R., the Middle East, China, the Republic of Korea, and the ASEAN countries.[2]

Recent trade developments in New Zealand include a long-term trade agreement with Australia. New Zealand has traditionally maintained high import duties to obtain government revenues and to discourage imports. Now about 80 percent of all Trans-Tasman trade (with Australia) is duty free. New Zealand is Australia's third largest export market and sixth largest import source, and Australia is New Zealand's largest two-way trade partner. Under the new trade agreements, all import duties imposed on Australian products will be lifted by 1995.[14]

New Zealand offers substantial long-term trade opportunities to the United States, with plans to eliminate all

import licensing requirements by 1990. In 1981, New Zealand imported $921.7 million of U. S. goods, and exported $715.2 million of goods to the U. S.[15] In 1982, this trade was $774.5 million of exports to the U. S., and $897.2 million of imports from the U. S.[16]

From a minerals aspect, New Zealand has only a few important minerals, and the economic base in the country does not require large amounts of minerals, so trade is not extensive in this area. Tables 6-6 and 6-7 show mineral commodity imports and exports, respectively, and trading partners for 1981.

## MINERAL COMMODITY ANALYSIS

New Zealand's mineral industry remains only a modest contributer to the island nation's economy, despite some gains in output of both domestic crude mineral products and in the mineral processing sector.[17] The country is not considered richly endowed with natural resources. Table 6-8 shows at a glance the country's mineral imports, exports, production, and import dependence of most common minerals. Of particular significance is the small quantities of many minerals, clearly indicating the small scale of New Zealand's industrial base.

Table 6-6. Principal Mineral Imports, 1981
(Metric Tons)

| Metals | Quantity | Trading Partner(s) |
|---|---|---|
| Aluminum | 311,529 | Australia |
| | | Canada |
| Copper | 14,340 | Australia |
| Iron and Steel | 489,405 | Japan |
| | | Australia |
| Lead | 5,763 | Australia |
| Manganese | 1,530 | Australia |
| Silver (Troy Ounces) | 767,125 | Australia |
| Titanium | 3,004 | Australia |
| Zinc | 88,746 | Australia |

| Non-Metals | Quantity | Trading Partner(s) |
|---|---|---|
| Asbestos | 5,003 | Canada |
| Barite and Witherite | 2,476 | Australia |
| Cement | 3,531 | Japan |
| Clays | 11,743 | United Kingdom |
| | | United States |
| Fertilizers | 1,097,907 | United States |
| | | Canada |
| Gypsum | 119,954 | Australia |
| Phosphates | 885,205 | Christmas Island |
| Salt | 65,104 | Netherlands Antilles |
| Sodium | 36,684 | United States |
| Sulfur | 204,339 | Canada |
| | | United States |
| Talc | 3,026 | Australia |

| Mineral Fuels | Quantity | Trading Partner(s) |
|---|---|---|
| Coal | 48,588 | United States |
| | | Australia |
| Crude Oil (1000 Barrels) | 14,032 | Saudi Arabia |
| | | Indonesia |
| Refined Petroleum (1000 Barrels) | 205,731 | Australia |
| | | Far East |

Source: The Mineral Industry of New Zealand, U. S. Bureau of Mines, 1982.

Table 6-7. Principal Mineral Exports, 1981
(Metric Tons)

| Metals | Quantity | Trading Partner(s) |
|---|---|---|
| Aluminum | 131,752 | Japan<br>China |
| Copper | 4,378 | Australia |
| Iron and Steel | 2,924,843 | Japan<br>Indonesia<br>Australia |
| Lead | 66,149 | India<br>United Kingdom |
| Zinc | 60,855 | Australia |
| **Non-Metals** | **Quantity** | **Trading Partner(s)** |
| Cement | 132,710 | Papua New Guinea<br>French Polynesia<br>Samoa |
| Clays | 7,074 | Japan |
| Fertilizers | 14,653 | South Pacific Island Countries |
| Salt | 2,652 | Australia |
| **Mineral Fuels** | **Quantity** | **Trading Partner(s)** |
| Coal | 204,039 | Japan<br>Republic of Korea |
| Peat | 70,389 | Bahrain<br>Australia |
| Refined Petroleum (Barrels) | 14,720 | Pacific Islands |

Source: The Mineral Industry of New Zealand, U. S. Bureau of Mines, 1982.

Table 6-8. Commodity Imports, Production, Exports, and Import Dependence (Units are in Metric Tons Unless Otherwise Specified).

| Commodity | Imports | Production | Exports | Import Dependence |
|---|---|---|---|---|
| Aluminum | 311,529 | 169,600* | 131,152 | 100 |
| Chromium | 478 | 0 | 6 | 100 |
| Cobalt | 10 | 0 | 0 | 100 |
| Copper | 14,340 | 0 | 0 | 100 |
| Gold (Troy Ounces) | 0 | 6,166 | 0 | 0 |
| Iron and Steel | 489,405 | 5,170,200* | 2,924,843 | 0 |
| Lead | 5,763 | 7,000* | 66,149 | 0 |
| Manganese | 1,530 | 0 | 0 | 100 |
| Molybdenum | 55 | 0 | 20 | 100 |
| Nickel | 280 | 0 | 367 | 100 |
| Platinum Group Metals (Troy Ounces) | 518 | 0 | 73 | 100 |
| Silver (Troy Ounces) | 787,125 | 800 | 104,625 | 100 |
| Tin | 515 | 0 | 27 | 100 |
| Titanium | 3,004 | 0 | 1 | 100 |
| Tungsten | 721 | 15 | 27 | 100 |
| Zinc | 88,746 | 0 | 60,855 | 100 |
| Asbestos | 5,003 | 0 | 0 | 100 |
| Barite and Witherite | 2,476 | 0 | 20 | 100 |
| Cement | 3,531 | 0 | 132,710 | 100 |
| Clays | 16,743 | 182,000 | 7,074 | 0 |
| Feldspar and Fluorspar | 1,166 | 0 | 0 | 100 |
| Fertilizers | 1,097,907 | 0 | 14,653 | 100 |
| Gypsum | 119,954 | 0 | 802 | 100 |
| Salt | 65,104 | 55,000 | 2,652 | 52 |
| Sodium | 36,684 | 0 | 388 | 100 |
| Sulfur | 204,339 | 100 | 186 | 100 |
| Talc | 3,026 | 0 | 23 | 100 |
| Coal | 48,588 | 2,220,000 | 204,039 | 0 |
| Petroleum (1000 Barrels) | 39,763 | 22,951* | 15 | 63 |
| Natural Gas (Million Cubic Feet) | 0 | 204,402 | 0 | 0 |

*Production partially or all from imported raw materials.

Source: The Mineral Industry of New Zealand, U. S. Bureau of Mines, 1982.

## ENERGY MINERALS

### PETROLEUM

New Zealand's petroleum industry is in the infant stages with no crude oil being produced until 1978. In 1979, the government proposed a massive exploration program because of the severe economic stress oil prices were giving the country.[18] The McKee Oil and Gasfield has been New Zealand's only domestic source of crude oil, having an estimated reserve of 16 million barrels in 1980, and production of 3000 barrels of oil per day. The government's drilling program took effect in 1980, and by 1981, over 16 exploration grants to 26 companies were issued.[19] The government's commitment to oil exploration was demonstrated when over $300 million was paid from public funds for exploration from 1981-1984.[20] It is estimated that another $750 million will be paid by 1986.[21]

The oil exploration activities have netted significant increases in reserves and production of crude oil in New Zealand; the McKee Oilfield's reserves have been raised to over 33 million barrels. Production from this field has reached 4800 barrels per day, and a new field, the Pouri Oilfield, is producing 1800 barrels per day.[21] In January 1984, over 77 companies were participating in exploration with promising signs of large discoveries in the Great South Basin, offshore of South Island, but the seas are rarely calm, and exploration and development efforts are hampered by the weather.[22]

The Petroleum Corporation of New Zealand, PETROCORP, has conducted a majority of oil exploration and has reportedly

outlined seven major structures that could contain as much as a billion barrels of oil each.[23] With all of the potential oil discoveries and would-be investors, New Zealand can expect to become nearly self-sufficient on oil supplies, but at present, the country is extremely vulnerable to shortages caused by supply disruptions. Over 63 percent of all oil consumed in New Zealand must be imported. The country has only one oil refinery, and at the end of 1982, a national state of emergency was eminant because of strikers closing down the refinery. Gasoline supplies were nearly exhausted before the refinery was re-opened.[24] Figure 6-1 shows production, imports, and exports of petroleum in New Zealand. Particularly noteworthy are the declines in crude oil imports in 1973 because of the oil embargos, and imports since 1980 when domestic crude oil became available.

NATURAL GAS

Natural gas is the newest and most promising mineral commodity in New Zealand. Reserves have grown so rapidly that the government does not assist in any exploration costs. Two gas fields provide the bulk of the country's 6 trillion cubic feet of natural gas reserves. The Maui Gasfield contains 5.5 trillion cubic feet, and the Kapuni Gasfield contains 430 billion cubic feet.[25] The natural gas reserves of the McKee Gasfield have been initially estimated to be 95 million cubic meters, but conclusive figures have not been released.[21] The proven reserves of natural gas can provide 40 percent of New

Zealand's liquid fuel requirements by 1990.[25]

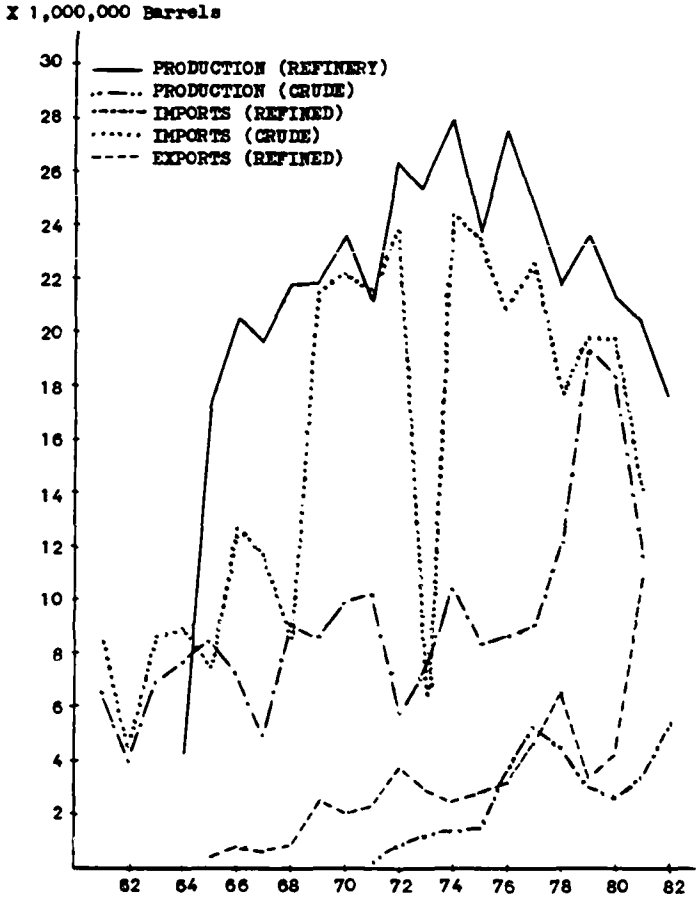



**Figure 6-1: Annual Production, Imports, and Exports of Petroleum in New Zealand, 1961-1982. Source: Minerals Yearbook, U. S. Bureau of Mines.**

In an effort to utilize the newly discovered natural gas in New Zealand, the government has approved a $1 billion synthetic fuels project with Mobil Oil Corporation for the conversion of natural gas into gasoline.[18] There is some public opposition to this plant, but no delays are anticipated. This plant will be the world's first large-scale synthetic fuels

plant and will be operated jointly by Mobil, owning 25 percent, and New Zealand's Synthetic Fuels Corporation, owning the rest. The plant will convert natural gas from the Maui offshore Gasfield into methane and then into synthetic gasoline using Mobil's zeolite catalyst gas conversion method. Bankers have surprisingly approved a $1.7 billion loan to finance the plant which will be constructed by Davy McKee of Great Britain.[26] In this action, the bankers broke one of their own golden rules; never take a technical risk with project financing. (Mobil's zeolit catalyst method has not been proven on a large scale.)[27] The plant is expected to be operational by 1985, with a daily production capacity of 400,000 gallons of gasoline.[27] If successful, it will put an end to New Zealand's $1 billion per year oil import bill. It has been speculated that the net cost per gallon of gasoline would be equivalent to normal gasoline prices based on a $12 price per barrel of crude oil.[28] With the present downward price of fuel in real terms, the profits will not be as high as previously expected, but the plant will not be cancelled.[29]

Other efforts to utilize natural gas in New Zealand includes the large-scale conversion of 2000 vehicles per month from gasoline to compressed natural gas. This saves up to 50 percent on personal gas bills, but a key factor in this savings is the government's guaranteed natural gas prices.[28] Figure 6-2 shows the rapidly increasing production of natural gas in New Zealand.

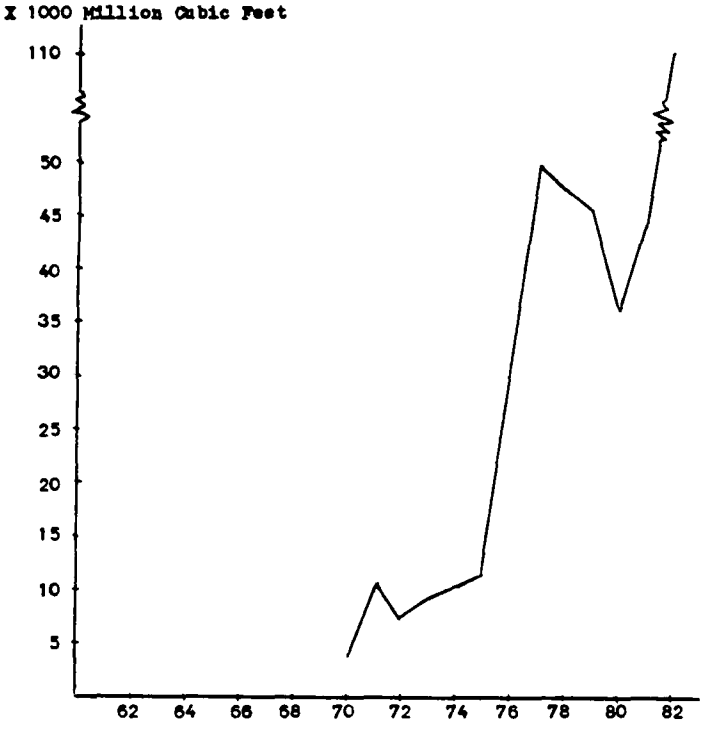



Figure 6-2: Annual Production of Natural Gas in New Zealand, 1961-1982.
Source: Minerals Yearbook, U. S. Bureau of Mines.

COAL

Coal is another important mineral commodity in New Zealand. The reserves estimates are extensive as shown in Table 6-9, and are based on 50 percent lignite extraction rates and 400 meters maximum mining depth for underground coal.[2] Total recoverable coal in all categories is 3.9 billion tons.

Coal output averages only about 2.14 million tons annually, and in 1979, a coal export program was initiated, but it did not affect output levels. Coal output is by some 70 individual mines on both islands, and about 70 percent of total output is from open cast mines.[17] Figure 6-3 shows coal

production in New Zealand. Much of the bituminous coal in the country is high-quality coking coal.[17]

Table 6-9. Coal Reserves in New Zealand, 1981

| Type | Number of Coalfields | Measured* | Indicated* | Inferred* |
|---|---|---|---|---|
| Bituminous | 7 | 36.6 | 30.6 | 92.7 |
| Sub-Bituminous | 20 | 233.0 | 205.1 | 306.8 |
| Lignite | 7 | 52.7 | 3,550.6 | 77.2 |
| Total | 34 | 327.3 | 3,786.6 | 476.7 |

*Quantities are in millions of metric tons.

Source: New Zealand Statistical Yearbook 1983, Department of Statistics, Wellington, 1983.


Figure 6-3: Annual Production of Coal in New Zealand, 1961-1982.
Source: Minerals Yearbook, U. S. Bureau of Mines.

## METALLIC MINERALS

### ALUMINUM

New Zealand has no domestic supplies of bauxite, but with the abundance of coal, and now natural gas, the country has an electric power surplus and has become an aluminum smelting country, nearly all for export. The Tiwai Point Aluminum

Smelter, near Bluff, at the southern tip of South Island, is operated by New Zealand Aluminum Smelters Ltd., and is the only smelter in the country. The plant has been expanding with a third potline being added in 1982, giving the smelter a total capacity of 245,000 metric tons per year.[17] Figure 6-4 shows production, imports, and exports of aluminum in New Zealand. Approximately 80 percent of smelter output is exported, and the remaining 20 percent is used by domestic fabricators to produce a wide range of aluminum products for domestic use.[18]

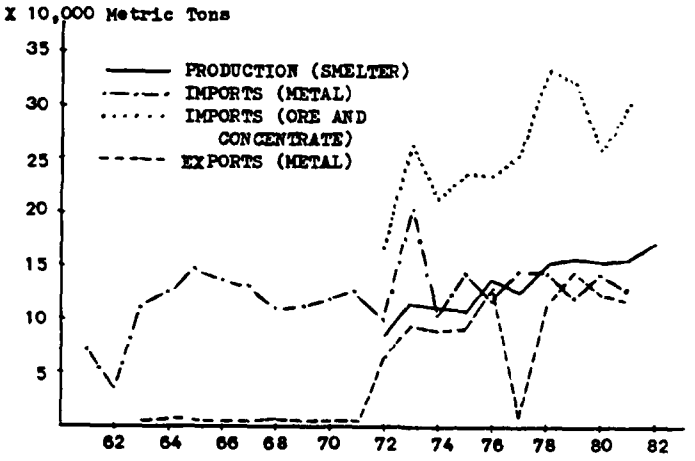



**Figure 6-4: Annual Production, Imports, and Exports of Aluminum in New Zealand, 1961-1982.**
**Source: Minerals Yearbook, U. S. Bureau of Mines.**

COPPER

New Zealand has some copper as lode deposits and massive-sulfide lenses, but the ore grade is so low that all domestic copper production was suspended in 1973.[30] Since the country has no smelting capacity, all copper is imported as scrap, unwrought, and semimanufactures.[18] Figure 6-5 shows

copper production, imports, and exports in New Zealand.

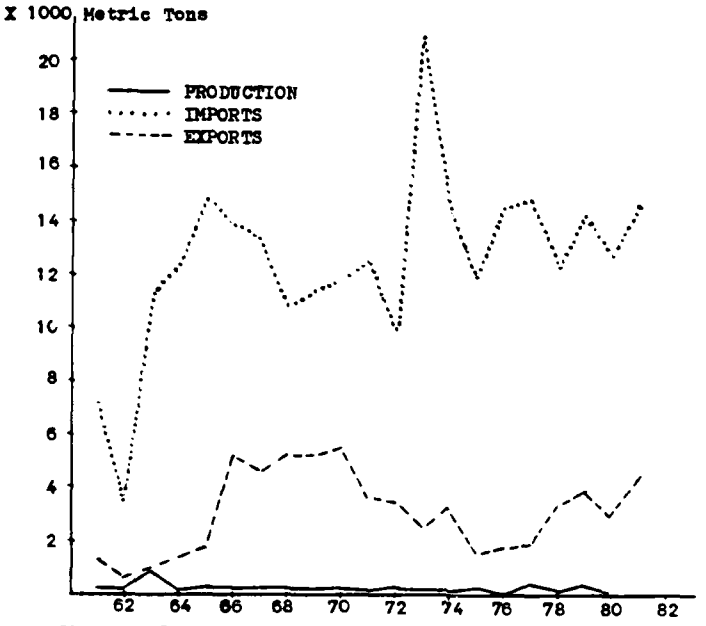



Figure 6-5: Annual Production, Imports, and Exports of Copper in New Zealand, 1961-1982.
Source: Minerals Yearbook, U. S. Bureau of Mines.

IRON AND STEEL

New Zealand's largest resources of iron ore are contained in the black sands of the western beaches of both North and South Islands. Titanomagnetite sands make up the bulk of the sand on North Island, and ilmenite is the chief iron-bearing mineral on South Island.[2] In terms of value, New Zealand's titaniferous magnetite sands are the country's most important non-fuel mineral commodity. Three major deposits are being exploited by two companies; Waipipi Iron-Sands Ltd. mines iron sands solely for export to Japan, and New Zealand Steel Mining provides some iron sand for export, but most of its output is for its own direct-reduction steel plant at Glenbrook, the only

iron ore/iron sand consuming steel smelter in the country. New Zealand's second steel plant is operated by Pacific Steel Ltd., and has been using scrap as its source of iron and steel since 1968.[17]

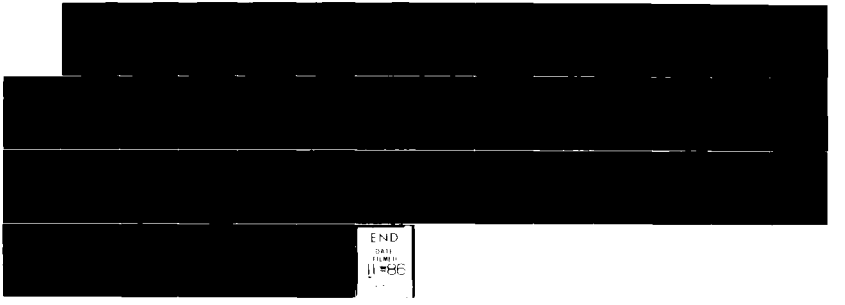
Production of magnetite beach sands has been declining since 1980 because of the worldwide steel surplus and reductions in Japanese contracts. Much of the production is from dredging operations in the lower river basins near the coast, and more rivers are being considered for dredging, but strong environmental opposition has been delaying exploitation. One river, the Mikonui, south of Ross, reportedly contains alluvial deposits of iron sand over 130 feet thick and would require sophisticated equipment to extract the sands. Two firms are involved in the exploitation of this river; Standard Oil of Ohio and the Anglo-American Corporation.[12] Figure 6-6 shows iron and steel production, imports, and exports in New Zealand. Production of the beach sands includes dredging, magnetically separating the iron from the gangue minerals, making a slurry concentrate, and piping it offshore to ore carriers for shipment to Japan.[12] Present Japanese contracts include requirements for 27,000,000 metric tons of iron sand concentrate by 1988.[13]

NICKEL

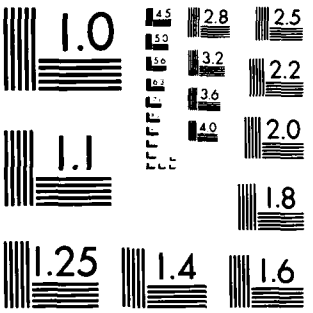
New Zealand is 100 percent import-dependent for its nickel supplies, and due to the small size of its iron and steel industry, the quantity required is quite small. All

AD-A172 197 AN ANALYSIS OF THE MINERAL INDUSTRIES OF THE REPUBLICS 2/2
OF CHINA THE PHILI..(U) ARMY MILITARY PERSONNEL CENTER
ALEXANDRIA VA P C SPINLER DEC 84

UNCLASSIFIED F/G 5/3 NL



END
DATE FILMED
11-86



nickel is imported as matte or metal from Australia. Figure 6-7 shows imports of nickel in New Zealand.[18]

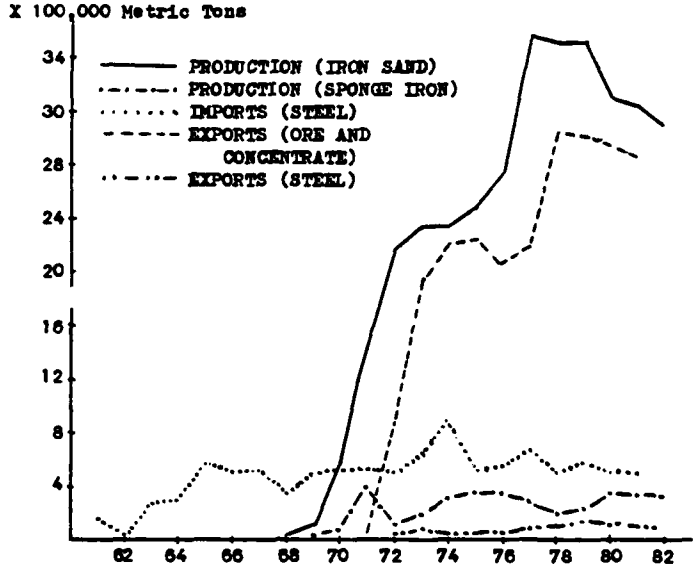



Figure 6-6: Annual Production, Imports, and Exports of Iron and Steel in New Zealand, 1961-1982. Source: Minerals Yearbook, U. S. Bureau of Mines.

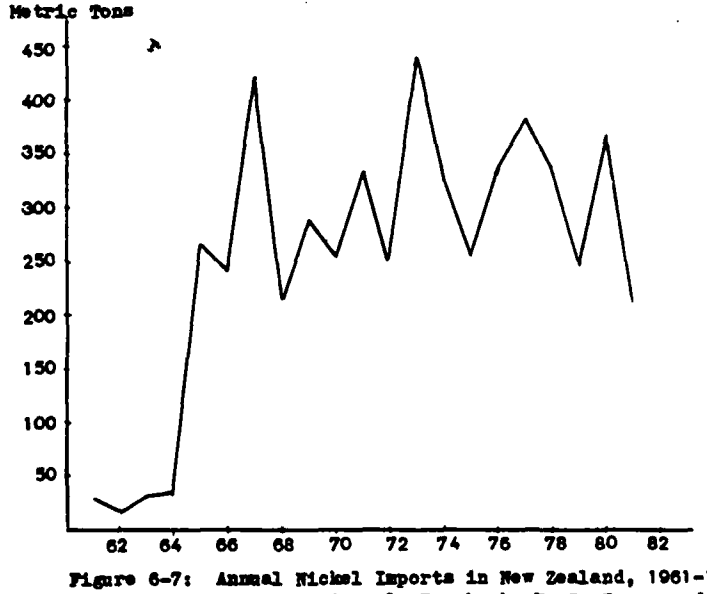



Figure 6-7: Annual Nickel Imports in New Zealand, 1961-1982. Source: Minerals Yearbook, U. S. Bureau of Mines.

MANGANESE

Small amounts of manganese minerals occur in older sedimentary rocks in New Zealand. Prior to 1960, some production was reported in several parts of the country, but the deposits are generally small and shallow and capable of producing only limitted tonnages of ore.[2] Presently, New Zealand imports all of its manganese supplies. Figure 6-8 shows the imports of manganese in New Zealand.

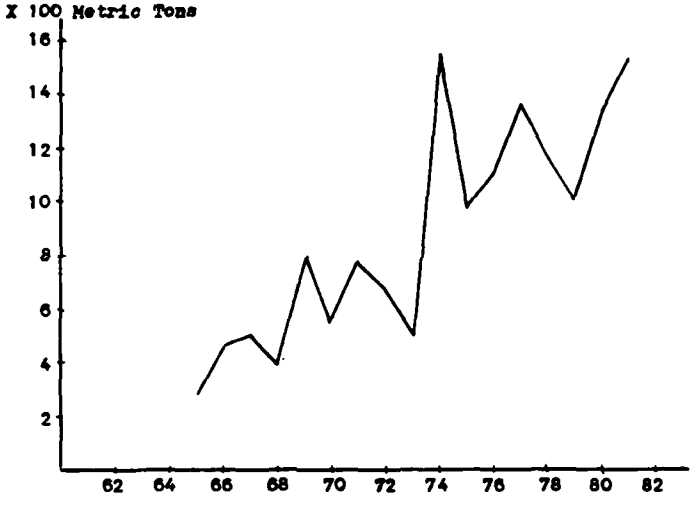



**Figure 6-8: Annual Imports of Manganese in New Zealand, 1961-1982.**
**Source: Minerals Yearbook, U. S. Bureau of Mines.**

LEAD

A lead-zinc-bearing reef in the northeast part of North Island has been mined for lead-copper sulfide and zinc sulfide, but operations ceased in 1973. As a result, New Zealand is totally dependent upon imports for lead supplies.[18] Figure 6-9 shows lead production, imports, and exports in New Zealand. Production and exports are from imported raw materials.

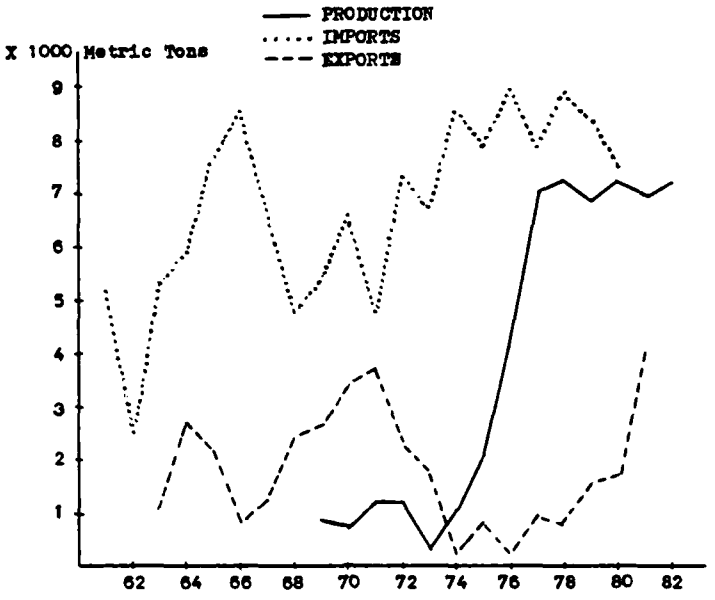



Figure 6-9: Annual Production, Imports, and Exports of Lead in New Zealand, 1961-1982.
Source: Minerals Yearbook, U. S. Bureau of Mines.

TUNGSTEN

Scheelite and wolframite have been mined in small quantities from gold-bearing quartz veins, but such operations became uneconomical in 1975 because of rising energy prices. Now New Zealand is 100 percent import-dependent for tungsten supplies and imports them all as metals from Europe.[4] Figure 6-10 shows tungsten production and imports in New Zealand.

TITANIUM

Although much of New Zealand's iron sand deposits contain extractable amounts of titanium minerals, the country's mineral industry does not extract it from the iron-bearing sand, but exports the iron-titanium sand to Japan. As a result, New Zealand must import all of its titanium, and receives oxides from Australia. Figure 6-11 shows the import pattern of

titanium in New Zealand.

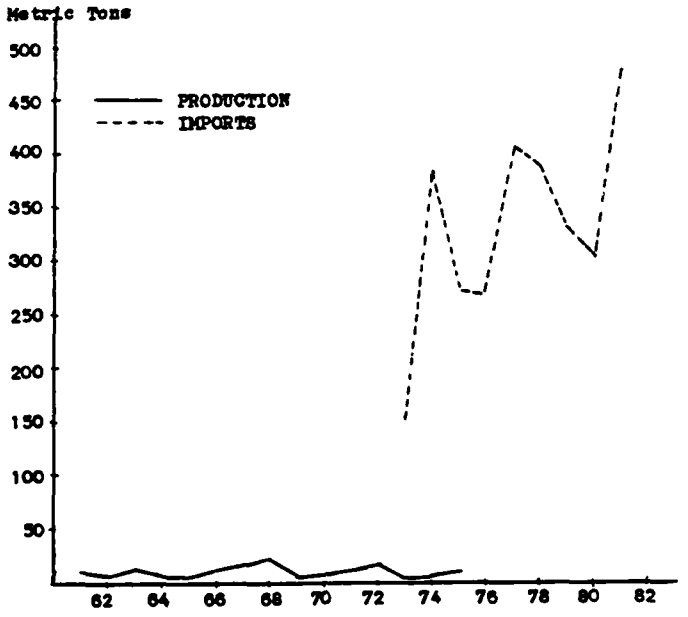



Figure 6-10: Annual Production and Imports of Tungsten in New Zealand, 1961-1982.
Source: Minerals Yearbook, U. S. Bureau of Mines.

TIN

New Zealand is totally dependent upon imports for tin, importing small amounts every year for over 20 years. Figure 6-12 shows imports and exports of tin in New Zealand. The large exports in 1964-1966 represent sizeable amounts of tin scrap that were exported to West Germany, the Netherlands, and Japan.

ZINC

As stated earlier, zinc sulfide production in New Zealand was suspended in the early 1970's. Now the country imports all of its zinc as unwrought metal from Australia. Figure 6-13 shows the zinc production, imports, and exports in

New Zealand.

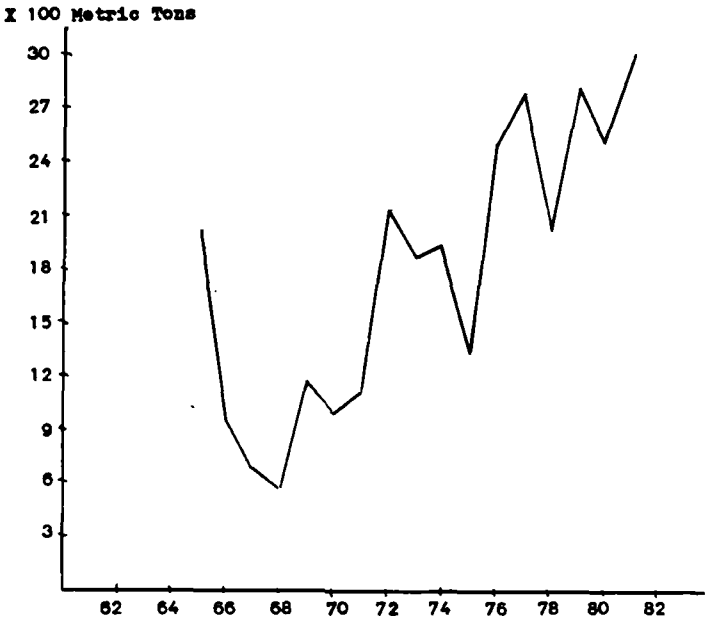



Figure 6-11: Annual Imports of Titanium in New Zealand, 1961-1982.
Source: Minerals Yearbook, U. S. Bureau of Mines.

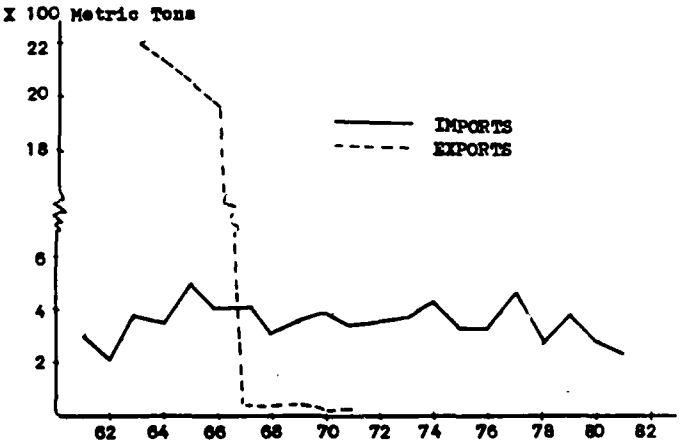



Figure 6-12: Annual Imports and Exports of Tin in New Zealand, 1961-1982.
Source: Minerals Yearbook, U. S. Bureau of Mines.

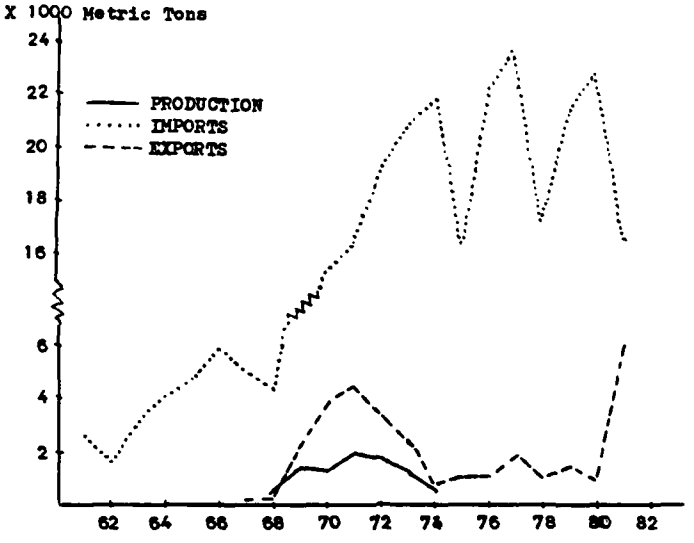



Figure 6-13: Annual Production, Imports, and Exports of Zinc in New Zealand, 1961-1982.
Source: Minerals Yearbook, U. S. Bureau of Mines.

PLATINUM GROUP METALS

New Zealand's import and export patterns of platinum group metals, as shown in Figure 6-14, are similar to those of other countries; very erratic and unpredictable, but in New Zealand, they are on a very small scale.[18] Most of the imports and exports are unwrought platinum metal.

GOLD

Gold production in New Zealand has declined significantly since the 1950's. This has been attributed to the exhaustion of both the more accessible alluvial gold deposits and gold ore from zones of enrichment.[17] The grade of New Zealand's gold deposits is among the lowest in the world, and none of the deposits possess any potentially significant characteristics, even by the modest standards of New Zealand's

small mineral industry.[4] Figure 6-15 shows gold production, imports, and exports in New Zealand.

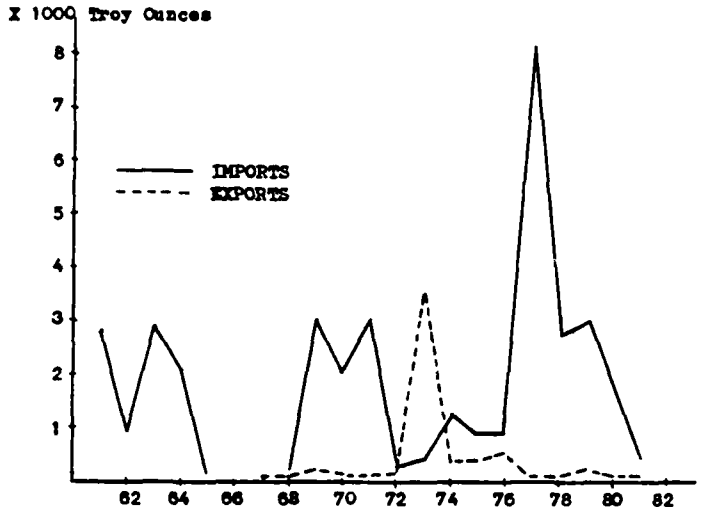



Figure 6-14: Annual Imports and Exports of Platinum Group Metals in New Zealand, 1961-1982.
Source: Minerals Yearbook, U. S. Bureau of Mines.

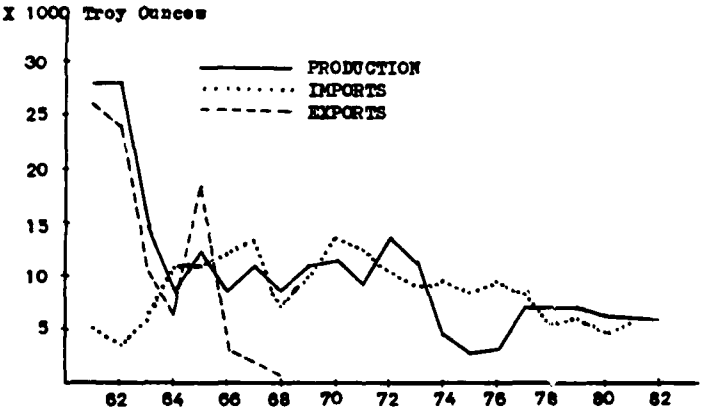



Figure 6-15: Annual Production, Imports, and Exports of Gold in New Zealand, 1961-1982.
Source: Minerals Yearbook, U. S. Bureau of Mines.

SILVER

Small amounts of silver occur in New Zealand alloyed with gold as argentite in lode veins on North Island.[30] Native silver and other ores are also found, but silver production in the country has been unable to satisfy domestic demand, so New Zealand imports nearly all of its silver requirements. Rising energy prices in the mid-1970's had an almost devastating impact of the New Zealand economy, and is clearly demonstrated by the import pattern shown in Figure 6-16.

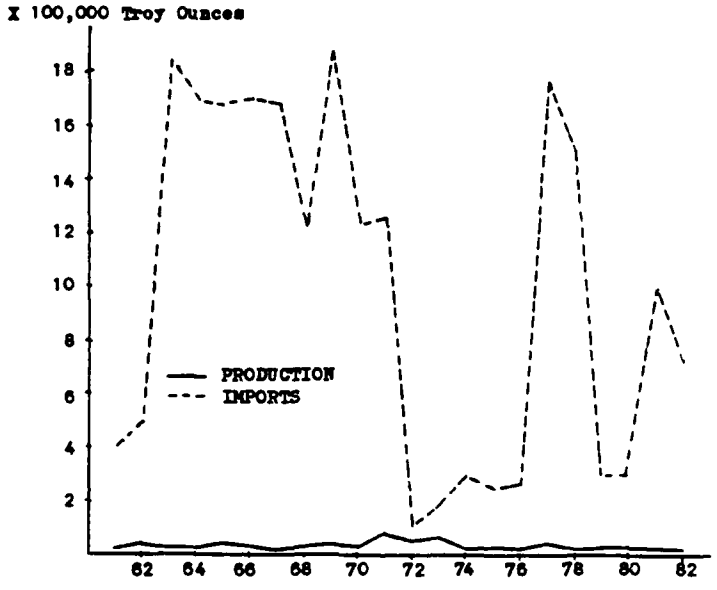



**Figure 6-16: Annual Production and Imports of Silver in New Zealand, 1961-1982.**
**Source: Minerals Yearbook, U. S. Bureau of Mines.**

## NON-METALLIC MINERALS

ASBESTOS

Although some exploratory drilling has been done since 1977, asbestos supplies in New Zealand must all be imported.[11]

The Tennecott Copper Corp. of the United States and a New Zealand company are presently participating in a joint venture to explore for asbestos in New Zealand. These companies have located chrysotile asbestos deposits, associated with serpentines, at a number of locations on South Island. Further work is required to establish the limits of the mineralization and tests on the fiber indicate that it is of favorable quality.[17] Figure 6-17 shows asbestos imports in New Zealand.

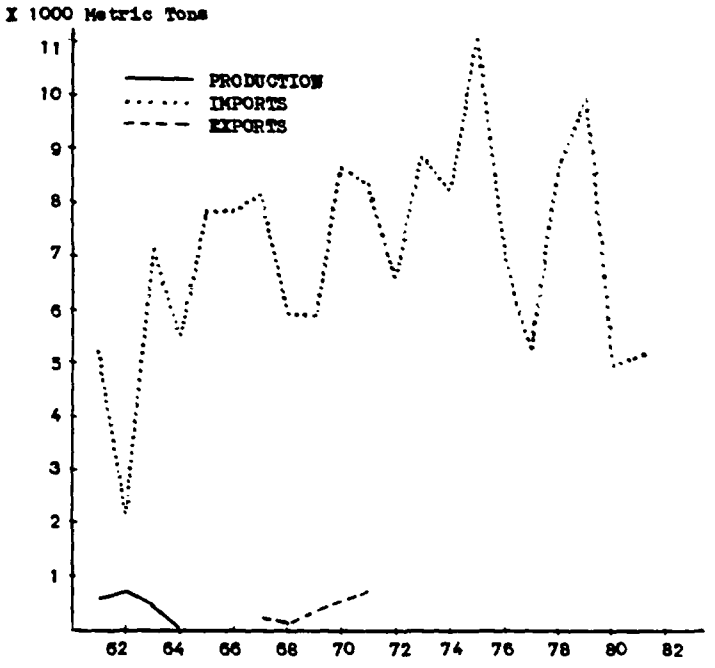



**Figure 6-17: Annual Production, Imports, and Exports of Asbestos in New Zealand, 1961-1982.**
**Source: Minerals Yearbook, U. S. Bureau of Mines.**

BARITE AND WITHERITE

New Zealand is 100 percent import-depdendent for barite supplies. Figure 6-18 shows the import patterns of barite and witherite. Each significant increase in imports corresponds

to the years the New ealand Government promoted oil exploration and drilling.[18] Significantly, a drilling grade of bentonite clay was discovered in the late 1970's, and was used in nearly all of the natural gas drilling in the country. If this had not been the case, barite and witherite imports would have skyrocketed in 1978-1982.[18]

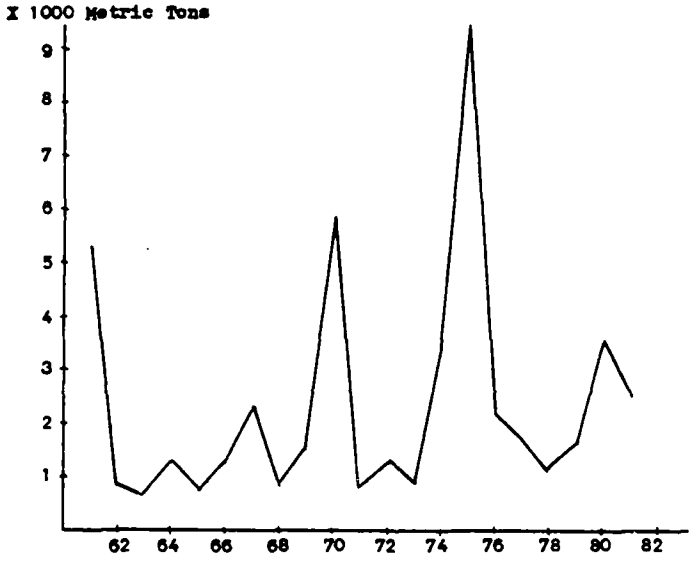



**Figure 6-18: Annual Imports of Barite and Witherite in New Zealand, 1961-1982.**
**Source: Minerals Yearbook, U. S. Bureau of Mines.**

CLAY

Clay production in New Zealand has been declining significantly since the 1950's as shown in Figure 6-19. Bentonite clay dominates the industry with measured reserves of 12 million tons and indicated reserves accounting for at least 8 million more tons. Strip mining is used, and typical seams are about 60 meters thick. Overseas industry has shown an interest in these high quality clay deposits with applications in pelletizing

iron sands, drilling muds, bonding foundry sands, emulsions, and fillers.[17] Two other types of clay: kaolin and halloysite, are being mined on North Island for the ceramics and paper industries.[18]

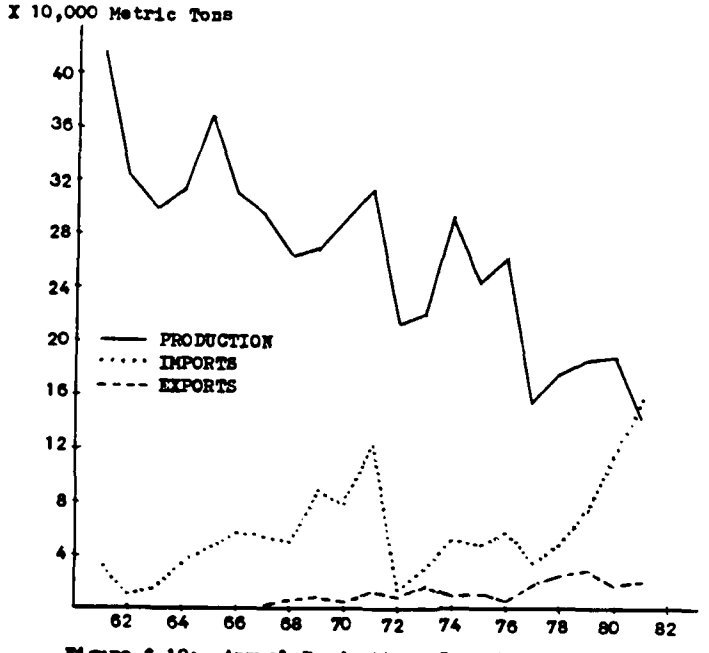



**Figure 6-19: Annual Production, Imports, and Exports of Clay and Clay Products in New Zealand, 1961-1982.**
**Source: Minerals Yearbook, U. S. Bureau of Mines.**

CEMENT

New Zealand produces enough cement to meed its demands, with two major cement manufacturers; Goldon Bay Cement Co. Ltd., on South Island, and New Zealand Cement Holdings Ltd., on North Island.[18] Cement production and imports are shown in Figure 6-20. Significantly, the sharp rise in oil prices in 1973 has severely curtailed construction in New Zealand, causing a decline in cement production.

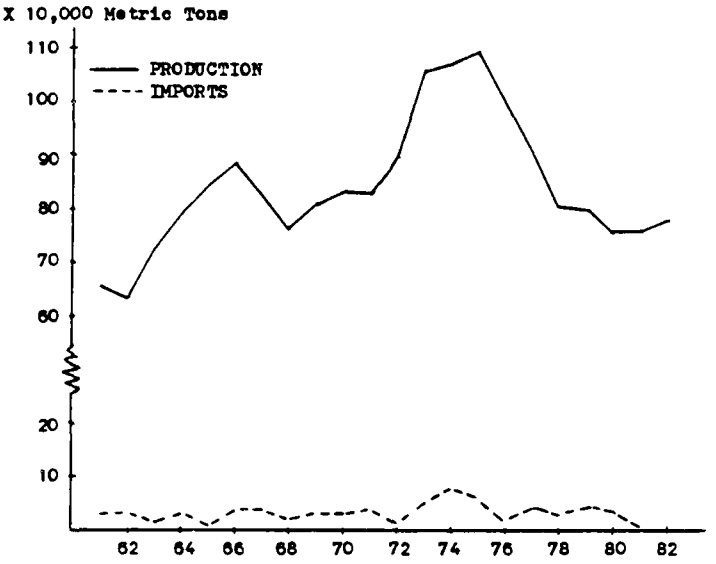



**Figure 6-20: Annual Production and Imports of Cement in New Zealand, 1961-1982.**
**Source: Minerals Yearbook, U. S. Bureau of Mines.**

DIAMONDS, PRECIOUS, AND SEMI-PRECIOUS STONES

New Zealand imports a modest amount of diamonds and precious and semi-precious stones, mostly from India. A majority of these imports are gem diamonds for jewelry and the remaining share is industrial diamonds for drill bits and other applications. Figure 6-21 shows imports and exports of diamonds and gemstones in New Zealand.

LIMESTONE

Limestone occurs in vast quantities in Tertiary age formations with considerable outcrops on North Island. Older Paleozoic limestone formations are located on South Island.[30] Limestone in New Zealand is used in a variety of ways, but over two-thirds of all domestic production is used in agricultural

applications. Domestic production of lime has increased nearly two-fold since 1960 and has been sufficient to satisfy demands. Figure 6-22 shows the production pattern of limestone in New Zealand.[18]

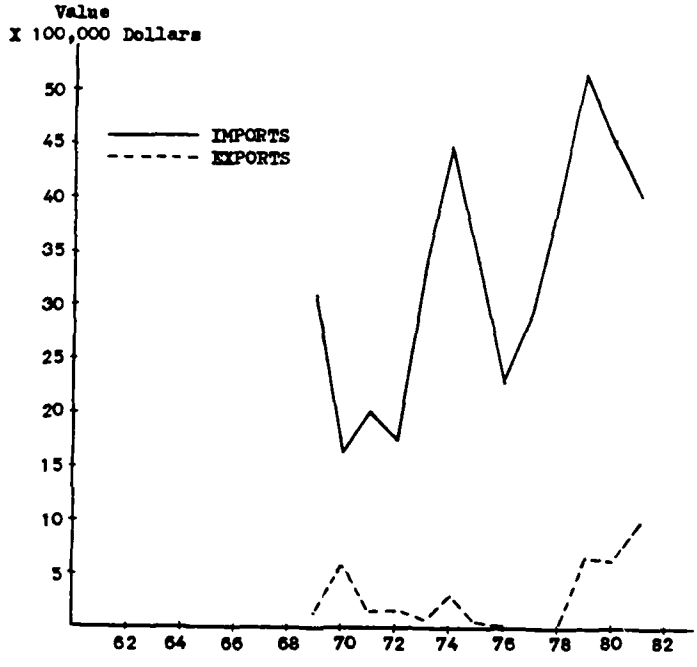



**Figure 6-21:** Annual Imports and Exports of Diamonds and Precious and Semi-precious Stones in New Zealand, 1961-1982.
Source: Minerals Yearbook, U. S. Bureau of Mines.

FERTILIZER

New Zealand has been almost totally import-dependent for fertilizer supplies since 1968, when the country suddenly stopped producing it because of a lack of domestic raw materials.[18] Presently the country is gaining ground on its fertilizer import-dependency. In 1982, construction of an ammonia-urea plant, owned by Petrochem New Zealand Ltd. was completed. The facility operates on natural gas and has an annual capacity

of 155,000 tons. It will produce nitrogenous fertilizer.[4]

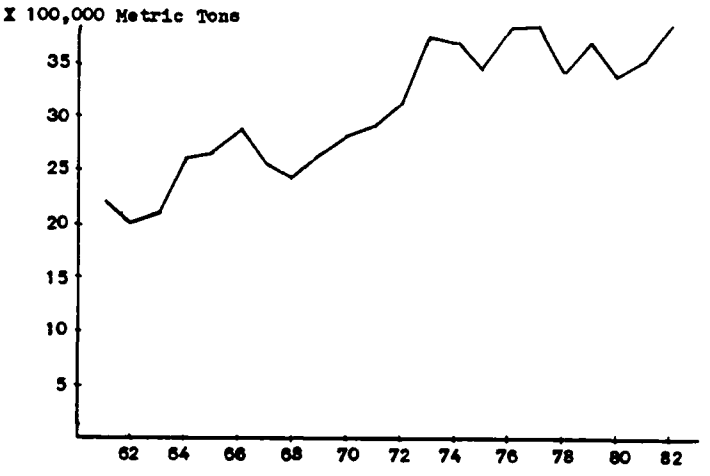



Figure 6-22: Annual Production of Limestone in New Zealand, 1961-1982.
Source: Minerals Yearbook, U. S. Bureau of Mines.

Sea floor phosphate nodules in the Chatham Sea appear to be a very promising source of phosphate fertilizer. These nodules range in size from 10 to 150 millimeters in diameter and occur in waters 400 to 500 meters deep. Their $P_2O_5$ content ranges from 18 to 27.7 percent, and the economic evaluation of these nodules is still continuing.[17] Figure 6-23 shows fertilizer production, imports, and exports in New Zealand.

GYPSUM

New Zealand imports all of its gypsum supplies from Australia. Figure 6-24 shows the gypsum imports in the country.

SALT

Salt production in New Zealand is all from solar evaporation of sea water. Because of this, production is highly

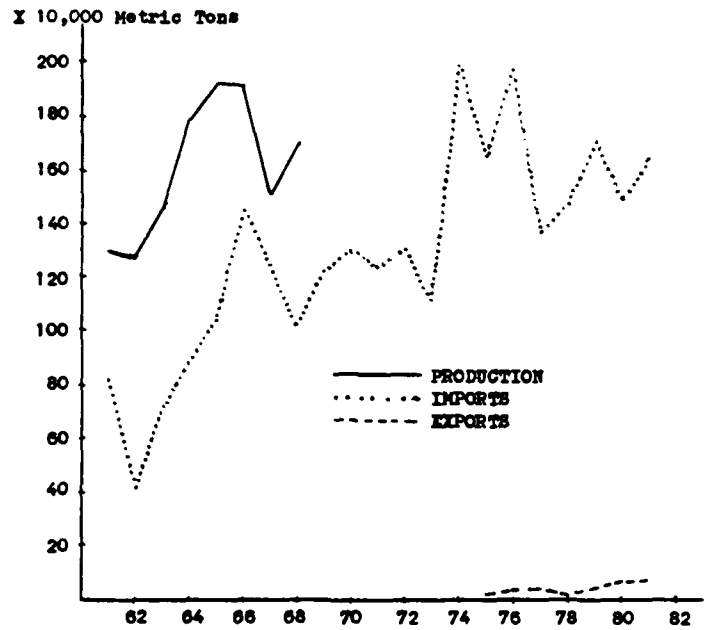



Figure 6-23: Annual Production, Imports, and Exports of Fertilizer in New Zealand, 1961-1982.
Source: Minerals Yearbook, U. S. Bureau of Mines.

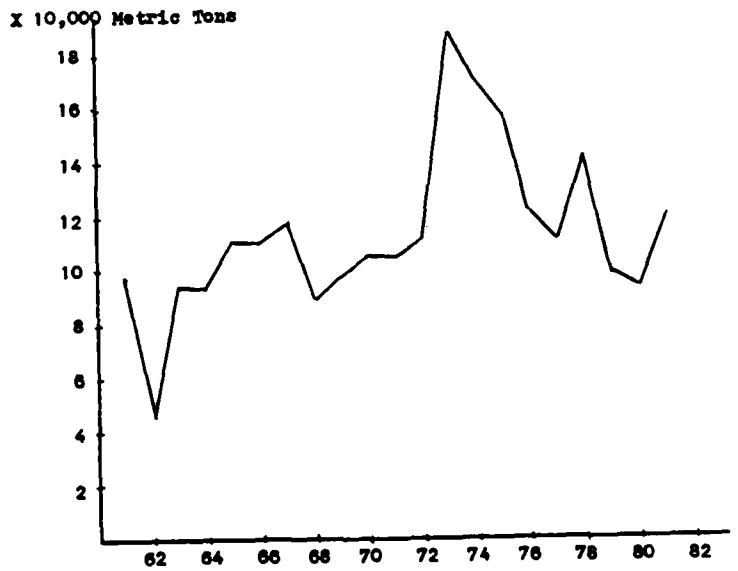



Figure 6-24: Annual Imports of Gypsum in New Zealand, 1961-1982.
Source: Minerals Yearbook, U. S. Bureau of Mines.

susceptable to bad weather interruptions, the most severe of which occurred in 1980, when production fell to almost zero because of a typhoon. Production does not keep pace with rising consumption, so nearly one-half of New Zealand's salt demands are satisfied with imports. Figure 6-25 shows salt production and imports in New Zealand.

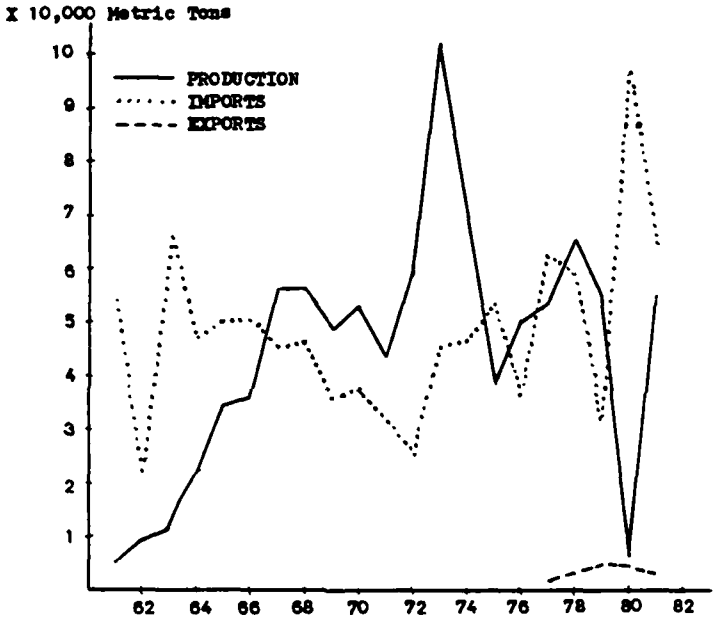



**Figure 6-25: Annual Production, Imports, and Exports of Salt in New Zealand, 1961-1982.**
**Source: Minerals Yearbook, U. S. Bureau of Mines.**

SULFUR

New Zealand is virtually 100 percent import-dependent for sulfur supplies. In 1973, a deposit of sulfur was discovered on North Island with measured reserves equal to over 6 million tons, and several attempts have been made to extract this sulfur. The Frasch method of extraction was attempted

using hot water from nearby geothermal sources, but was unsuccessful because of the porosity of the overlying formations. Fletcher Mining Co. Ltd. began development work and escavation to exploit the deposit using open pit mining methods, but the sulfur is mixed with pumice, and research on a separation process has not been completed yet. No work on the deposit has been done since 1981.[17] Figure 6-26 shows the production and imports of sulfur in New Zealand.

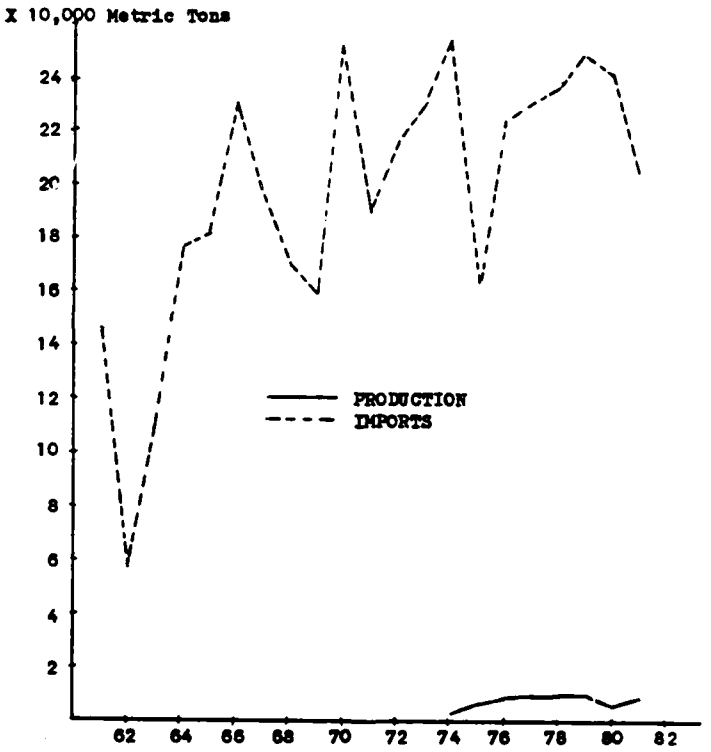



Figure 6-26: Annual Production and Imports of Sulfur in New Zealand, 1961-1982.
Source: Minerals Yearbook, U. S. Bureau of Mines.

TALC

New Zealand has small talc deposits occurring as dikes and pods in serpentine rocks, but due to their physical

configuration, they are either marginally economical or not economical at all.[30] All of the country's talc requirements are satisfied with imports from Australia and China. Figure 6-27 shows imports of talc in New Zealand.

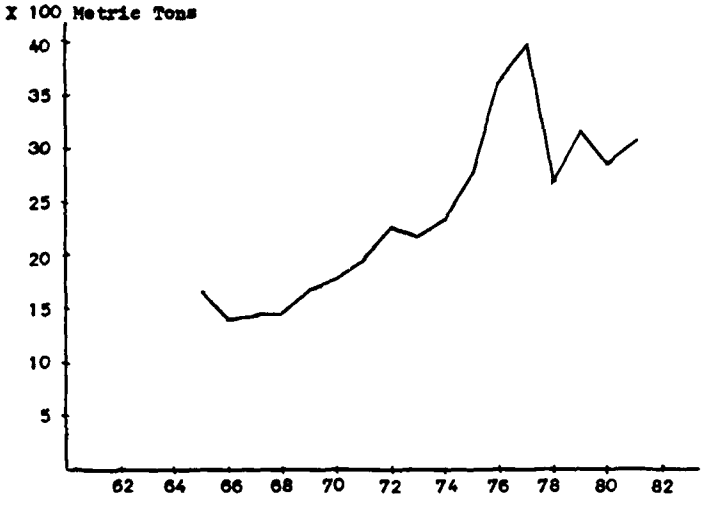



**Figure 6-27: Annual Imports of Talc in New Zealand, 1961-1982. Source: Minerals Yearbook, U. S. Bureau of Mines.**

SAND, STONE, AND GRAVEL

Figure 6-28 shows the production of sand, stone, and gravel in New Zealand. Particularly noteworthy is the fact that in 1967, these commodities ranked first in importance among New Zealand's minerals. Another significant observation concerning these commodities is that, unlike those in other countries, the consumption of building materials in New Zealand has declined over the past two decades. All other countries show continuous increases.

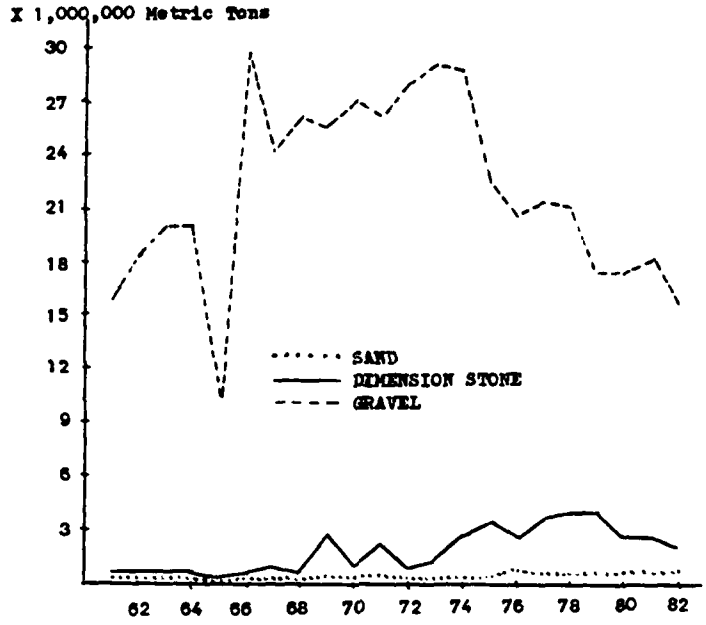



Figure 6-28: Annual Production of Sand, Dimension Stone (Except Limestone), and Gravel in New Zealand, 1961-1982.
Source: Minerals Yearbook, U. S. Bureau of Mines.

## GOVERNMENT POLICY STRATEGIES

New Zealand faces problems regarding long-range policies because of the country's two major political parties, the Labor Party and the conservative National Party, having conflicting stands on the country's development. In the early 1970's, the Labor Party's total lack of support of the minerals industry caused exploration to stop completely. Then after re-election in 1975, and subsequent re-elections, the National Party resumed playing an active role in New Zealand's exploration and development. This policy was prompted by the country's heavy dependence on imports and the reasons for mineral and mining companies' renewed interest include the fact that rules are now clear and appear to be stable, and the government is advertising

worldwide that it has blocks available for exploration instead of waiting for applicants to appear. The New Zealand Government has been rated highly for its cooperation with foreign investors and industry.[31] In the mid-1984 elections, the Labor Party resumed control of the New Zealand Government. Policies and programs initiated by the outgoing National Party may continue, or may be terminated. Only time will tell.

The government of New Zealand charges 10 percent of gross revenues as royalties, and pays up to 40 percent of the costs of approved exploration projects. In turn, 51 percent of new discoveries belong to the government.[31] There are no fixed rules on maximum levels of investment in New Zealand. Each case is considered by the government on its own merit. Government approval is required when there is 25 percent or more foreign equity involved. Projects or ventures involving $500,000 or less are automatically approved upon registration.[32]

Several investment incentives are offered in New Zealand. These incentives include: (1) a first year depreciation allowance of 25 percent on new plant and machinery, in addition to the normal depreciation allowed; (2) an export-manufacturing investment allowance - a deduction from assessable income of a percentage of the cost of the plant and machinery; (3) an export-performance incentive intended to reward successful export performance on a domestic added value basis allowing a percentage of the total value of exports to be offset against tax; (4) market development assistance - a tax deduction of 67.5 percent or a grant of approximately 80 percent of the export

market research and development costs for goods and services; (5) a regional investment allowance depending upon location, an investment allowance of up to 20 percent; and (6) a wide range of incentives to promote the commercial appraisal and development of resources in designated "priority regions."[33]

## RELATIONS WITH THE UNITED STATES

Continuing and close association with the United States is an essential part of New Zealand's foreign policy. The United States remains New Zealand's principal security guarantor, is a major trading partner, and has an important influence on the New Zealand way of life. The two countries share a common English-speaking heritage and a friendship of long standing, both in peace and war.[2]

The United States first had consular representation in New Zealand in 1839, concerning the work relating to American shipping and whaling. In 1942, formal diplomatic relations were established. The cornerstone of the NZ-US relations is one of defense treaties, allowing U. S. ships and submarines to enter New Zealand's ports.[1] A potential setback in relations could result from the new government's policies in New Zealand concerning nuclear power. One of the Labor Party's positions is to prohibit nuclear-powered ships and submarines from entering New Zealand's ports. This will have a significant impact on the U. S. Navy, which routinely uses New Zealand ports for resupply and repairs. This policy has not been placed into effect yet, and negotiations are currently under way to prevent

such an occurrence.

When New Zealand began experiencing a sharp economic downturn in 1982, the agricultural sector was hit very hard with escalating costs, drought, and low prices. The United States became the number two supplier of New Zealand's imports, second to Australia. Numerous governmental projects in New Zealand offered export incentives to U. S. producers.[34] The United States maintains about 14 percent of New Zealand's trade, and the value of this trade is likely to increase as the New Zealand Government's policies are implemented. The Government wants to change export commodities to more processed forms like sawn lumber instead of logs, steel and sponge iron instead of iron sand, and carpets instead of wool. They need the United States' help to accomplish this.[35]

## RELATIONS WITH AUSTRALIA

New Zealand's most comprehensive bilateral relationship is with Australia. Geographical proximity and shared foreign policy and mutual defense interests have reinforced the important historical, cultural, and Commonwealth ties between the two countries.[2] Despite close relations, economic ties between New Zealand and Australia have been strained because of New Zealand's import license requirements, but these problems are currently being resolved as stated earlier.[14]

## TAXES IN NEW ZEALAND

New Zealand's tax system is very much like that of the United States, with exemptions, credits, incentives, and income

tax returns. The current tax rates include a 45 percent tax on net income on resident companies, a tax of 50 percent on companies not incorporated in New Zealand, an income tax of 15 percent on gross dividends, interest, and royalties, and personal income tax on a graduated scale using five tiers. Double taxation agreements exist with many countries.[32]

## POLICY ANALYSIS CONSIDERATIONS

New Zealand can be viewed as an important Pacific ally because of defense considerations. Close ties with this island country affords the United States with flexibility in naval operations and a stable economic trade partner. From a minerals standpoint, New Zealand does not present itself as a source of supply to the United States. Its deposits are small and the mineral wealth of New Zealand, mainly iron, coal, timber, and natural gas, are also abundant in the United States.

REFERENCES


1 U. S. State Department, et al., Countries of the World and Their Leaders Handbook 1984 (Detroit: Gale Research Company, 1984).

2 Department of Statistics, Wellington, New Zealand Official Yearbook 1983 (Wellington, New Zealand: Department of Government Printing and Binding, September 1983).

3 Nick Williams and Mary Ronny, "New Zealand: A World All its Own," Publishers Weekly, July 3, 1981.

4 U. S. Department of the Interior, Bureau of Mines, "The Mineral Industry of New Zealand," by Charles L. Kimbell, Minerals Yearbook (Washington, D. C.: U. S. Government Printing Office, 1982).

5 Anon., "New Zealand: A Rediscovery in the South Pacific," Nation's Business, June 1981.

6 Anon., "New Zealand: Trade Incentives Available Until 1985," American Import-Export Management, March 1983.

7 Anon., "New Zealand: A Gamble on Gas to Fire the Economy," Business Week, September 28, 1981.

8 Gordon McLauchlan, "New Zealand Pressed for Access to Foreign Markets," The Journal of Commerce, April 13, 1982.

9 Gordon McLauchlan, "New Zealanders Argue over National Debt," The Journal of Commerce, December 23, 1982.

10 Anon., "International Corporate Report," Wall Street Journal, April 3, 1984, Sec. 2, p. 37e.

11 Anon., "New Zealand Stresses Natural Gas Use," Oil and Gas Journal, February 8, 1982.

12 Anon., "Worldwide Survey," World Mining, 1973-1984.

13 Anon., "What's Going on in World Mining," World Mining, 1973-1984.

14 Anon., "Australia-New Zealand Trade: Free at Last," The Economist, November 13, 1982.

15 David H. Hindle, "New Zealand: Economy Offers U. S. Long-Term Opportunities," Business America, August 9, 1982.

16 Gary Bauch, "New Zealand: Long-Range Outlook Bright Despite Present Difficulties," Business America, February 21, 1983.

17 U. S. Department of the Interior, Bureau of Mines, "The Mineral Industry of New Zealand," by Charles L. Kimbell, Minerals Yearbook (Washington, D. C.: U. S. Government Printing Office, 1981).

18 U. S. Department of the Interior, Bureau of Mines, "The Mineral Industry of New Zealand," by Charles L. Kimbell, Minerals Yearbook (Washington, D. C.: U. S. Government Printing Office, 1963-1982).

19 Jim Drummond, "Exploration Atmosphere Improves in Australia and New Zealand," The Oil Daily, September 9, 1981.

20 Jim Drummond, "New Zealand Leases Attract Many Firms," The Oil Daily, December 24, 1981.

21 Anon., "About $750 Million Due in New Zealand Search," Oil and Gas Journal, July 11, 1983.

22 G. Vernon Hough, "New Zealand: Optimistic Prospects for Exploration," Petroleum Economist, January 1984.

23 Jim Drummond, "New Zealand's Drilling Boom to Defy Weak World Oil Market," The Oil Daily, March 9, 1983.

24 Anon., "Strike Closes New Zealand Refinery," The Oil Daily, December 9, 1982.

25 Anon., "New Zealand Stresses Natural Gas Use," Oil and Gas Journal, February 8, 1982.

26 Anon., "NZ-Mobil Venture Seeks $1.7 Billion for Plant to Convert NG into Gasoline," Wall Street Journal, June 8, 1982, Sec. 2, p. 38e.

27 Wellington and London, "Is it Synful for Bankers to Think Big in New Zealand?" The Economist, June 12, 1982.

28 Jim Drummond, "Gasoline from Natural Gas Plan Pursued," The Oil Daily, March 3, 1983.

29 Jim Drummond, "New Zealand is Committed to Gas-to-Gasoline Project," The Oil Daily, April 7, 1982.

30 New Zealand Mines Department, The Mineral Deposits of New Zealand (Wellington: E. V. Paul, Government Printer, 1939).

31 Marcia A. Parker, "Action Simmering in New Zealand," Oil and Gas Journal, November 15, 1982.

32 Anon., "New Zealand: A Good Climate for Investors," Nation's Business, June 1981.

33 Robert McKinnon, "New Zealand Offers a Third Option," The Director, July 1981.

34 Gary Bauck, "New Zealand: Major Projects Offer Best Prospects During Decline," Business America, August 1983.

35 Gary Bauck, "New Zealand: U. S. Maintains its Share of Buoyant Import Market," Business America, February 8, 1982.

# CHAPTER SEVEN:

# CONCLUSION

An analysis of the mineral industries of the Philippines, Taiwan, South Korea, Thailand, and New Zealand reveals remarkable similarities and even more dramatic differences. Each country was affected economically by the 1973 Arab oil embargo. They were all extremely dependent upon imported oil to satisfy energy needs. After the embargo, each government began extensive exploration and seismic surveying for oil and gas deposits. To a varying degree, all of them were successful except the Republic of Korea, but all five countries have further developed their coal reserves to reduce their dependence upon imported oil. As a result of extensive exploration and development of domestic liquid energy supplies, consumption conversions, and widespread conservation measures, the 1979 oil shock had a much smaller effect on the economies of all five countries analyzed.

Each country is plagued with high external national debts relative to their gross national product. The Republic of the Philippines is in the worst position, followed by New Zealand. The Republic of Korea is in the best position, followed by Thailand. Taiwan's debt is manageable, but the tiny island country has been expelled from world lending and financing organizations because of the recognition of the People's Republic of China as the legitimate government of China. The debt picture of these countries and their ability to service

their debt is a fundamental concern of all potential investors in mineral or any other venture in their industrial sectors. Those countries such as New Zealand and the Philippines are not as attractive as South Korea.

Each government has swayed toward and away from accepting foreign firms into their country to develop their mineral resources. At present, all of them maintain attractive incentive policies to entice foreign investors. To an extent, they have no choice because their debt picture has mandated such a policy. Politically unstable situations in the Philippines and Thailand tend to discourage investments and joint ventures, but with the Labor Party gaining control in New Zealand in 1984, the attractiveness of New Zealand's exploration program could be diminished dramatically.

It is the policy of all of the surveyed countries to process minerals as much as possible prior to export, but the national debt, lack of interested foreign investors, world mineral situation, desire to maintain current mineral trading partners, and environmentalist groups have prevented them from making much progress in increasing domestic processing capacity.

Each country has diversified products, import sources, and export markets. New Zealand has the furthest to go in this respect, still being overly dependent on farm products exports. A remarkable characteristic that sets the Republic of Korea and the Republic of China apart from the other countries is their distinct pattern of following the industrializ-

ation trends that Japan has pursued. Each country's industrialization has concentrated on heavy industries such as the steel industry and petrochemical industries, and with the onset of world oil shortages in the 1970's, emphasis shifted toward high technology industries. Japan is 10 to 15 years ahead of South Korea and Taiwan, and did not have to contend with the present world energy problems and present trade policies. Additionally, neighboring countries have been developing right along with South Korea and Taiwan, and export markets for traditional manufactures are much more competitive than they were when Japan was developing.

Each country surveyed possesses mineral wealth and strategic value. It has been established that with their close proximity to Communist countries, these small Far East allies are viewed as critical to the United States' foreign policy. To prevent Communist influence or even outright takeover, they must be strong militarily and economically. Thus it is in the best interest interest of the United States to maintain strong military ties, continue to be a major trade partner, and to keep close, favorable diplomatic relations with all of these countries.

BIBLIOGRAPHY

Anon., "About $750 Million Due in New Zealand Search," Oil and Gas Journal, July 11, 1983.

Anon., "Alcoa Forms Venture With Taiwan Company," Wall Street Journal, October 17, 1983, Sec. 2, p. 3e.

Anon., "Asia-Pacific Report/Asia E & P Activity Holds High," Oil and Gas Journal, May 16, 1983.

Anon., "Atlas Consolidated Banks Set Terms for Postponing Debt," Wall Street Journal, August 30, 1982, Sec. 2, p. 17e.

Anon., "Austerity Budget Proposed by Taiwan," Wall Street Journal, April 13, 1982, Sec. 2, p. 38e.

Anon., "Australia-New Zealand Trades Free at Last," The Economist, November 13, 1982.

Anon., "Canada Agency Clears Exports of Crude Oil to Japan - South Korea," Wall Street Journal, April 27, 1983, Sec. 2, p. 4e.

Anon., "China is in, Taiwan is Out, Shows Report by the World Bank," Wall Street Journal, August 10, 1981, Sec. 2, p. 23e.

Anon., "China's Membership in IMF is Approved; Taiwan is Removed," Wall Street Journal, April 18, 1980, Sec. 2, p. 17e.

Anon., "Copra-Bottomed: The Philippines," The Economist, November 27, 1982.

Anon., "Daewoo Shipbuilding Gets a $140 Million Indian Order," Wall Street Journal, September 23, 1983, Sec. 2, p. 34e.

Anon., E. Hemisphere Deepwater Finds Scarce," Oil and Gas Journal, April 18, 1983.

Anon., "Energy Diversification Program, 11 Major Projects Provide Outlets for Sales While Economy Marks Time," Business America, November 2, 1981.

Anon., Ex-Im Bank Processes Taiwan Project Credit," Wall Street Journal, May 5, 1982, Sec. 2, p. 29e.

Anon., "Filipino's Cocodiesel is Fueling Vehicles and Buoying Price of Coconut Oil Crop," Wall Street Journal, May 29, 1981, Sec. 2, p. 40e.

Anon., "Filipino Steel Expansion is Scheduled by NASCO," American Metal Market, February 8, 1983.

Anon., "French, U. K. May Aid Thai Refinery Plan," The Oil Daily, August 19, 1982.

Anon., "Geothermal to Gain in Philippine's Energy Mix," Oil and Gas Journal, March 2, 1981.

Anon., "High Price of Gold Bullion Spurs Gold Mining Revival," World Mining, May 1978.

Anon., "High Success Ratios: Of 110 Wells Drilled in the Gulf of Thailand, 62 Have Been Brought in Successfully," Business in Thailand, October 1983.

Anon., "Higher Prices for Tungsten and Tin Should Increase Outputs in 1977 and 1978," World Mining, May 1977.

Anon., "IMF Approves Loan Totalling $963.7 Million," Wall Street Journal, June 8, 1981, Sec. 2, p. 31e.

Anon., "International Corporate Report," Wall Street Journal, April 3, 1984, Sec. 2, p. 37e.

Anon., "Key Rubber Producers to Restrict Supplies in Bid to Boost Price," Wall Street Journal, May 24, 1982, Sec. 2, p. 25e.

Anon., "Korea to Allow Foreigners to Buy Securities," Wall Street Journal, January 15, 1984, Sec. 2, p. 35e.

Anon., "Korean Deficit Narrowed to $1.62 Billion in 1983," Wall Street Journal, January 17, 1984, Sec. 2, p. 35e.

Anon., "Korea Steel Exports May be Injuring U. S. Firms, I. T. C. Rules," Wall Street Journal, December 8, 1983, Sec. 2, p. 22e.

Anon., "Many Filipino Industry Changes, Some Fear Nationalization," Variety, May 26, 1982.

Anon., "Marinduque Posts Loss of $16 Million for 1st Quarter 1981, Wall Street Journal, May 20, 1981, Sec. 2, p. 20e.

Anon., "Miners Up in Arms," Business Review, July 1983.

Anon., "Mitsui and Co.," New York Times, October 8, 1980.

Anon., "New Zealand," Mining Annual Review, 1983.

Anon., "New Zealand: A Gamble on Gas to Fire the Economy," Business Week, September 28, 1981.

Anon., "New Zealand: A Rediscovery in the South Pacific," Nation's Business, June 1981.

Anon., "New Zealand: 'Closer Economic Relations' With Australia, Major Projects Hold out the Prospects of a Brighter Economic Future," Business America, June 27, 1982.

Anon., "New Zealand: Development Projects Should Stimulate Economy and Provide Opportunity for U. S. Investors," Business America, April 19, 1982.

Anon., "New Zealand: Good Climate for Investors," Nation's Business, June 1981.

Anon., "New Zealand Keeps Australia Investment Ban," Wall Street Journal, June 21, 1983, Sec. 2, p. 39e.

Anon., "New Zealand; R. J. Reynolds," Wall Street Journal, April 22, 1981, Sec. 2, p. 32e.

Anon., "New Zealand Stresses Natural Gas Use," Oil and Gas Journal, February 8, 1982.

Anon., "New Zealand: Major Project Development Stimulates Demand for U. S. - Made High-Technology Products and Equipment," Business America, December 13, 1983.

Anon., "New Zealand: Trade Incentives Available Until 1985," American Import-Export Management, March 1983.

Anon., "NZ - Mobil Venture Seeks $1.7 Billion for Plant to Convert NG Into Gasoline," Wall Street Journal, June 8, 1982, Sec. 2, p. 38e.

Anon., "Offshore Tin Dredging Rights North of Bhuket to Billiton," World Mining, January 1977.

Anon., "Philex, Atlas Mines Stress Energy Consumption Decreases," World Mining, January 1977.

Anon., "Philippines 2000: Industrial and Technological Futures," Scientific America, January 1982.

Anon., "Philippines: A Rash of Strikes Sours a Sweet Deal With Labor," Business Week, August 9, 1982.

Anon., "Philippines Credit Availability Should Hold Lid on Imports in 1983," Business America, February 21, 1983.

Anon., "Philippine Government to Buy Benguet Copper," American Metal Market, August 17, 1982.

Anon., "Philippines Lures Investors with Attractive Package of Incentives," Business America, September 20, 1982.

Anon., "Philippines Move to Sweeten Terms on Oil Exploration," Wall Street Journal, June 28, 1982, Sec. 2, p. 19e.

Anon., "Philippines National Power Co - Westinghouse and Manila Settle Nuclear Dispute," Wall Street Journal, September 26, 1980, Sec.2, p. 33e.

Anon., "Philippine Oil Output," New York Times, August 13, 1981, p. 31n.

Anon., "Philippine Ports Authority Manning the Ports," Philippine Development, June 1982.

Anon., "Philippines Subsidizes its Copper Production to Keep Mines Running," Wall Street Journal, July 6, 1982, Sec. 2, p. 29e.

Anon., "Planned Foreign Investment Declines in Taiwan," Wall Street Journal, August 8, 1983, Sec. 2, p. 34e.

Anon., "President Marcos Issues Second Decree to Curb Gold Thefts at Mines," World Mining, September 1977.

Anon., "Republic of Korea," Mining Annual Review, 1983.

Anon., "Revised Budget Bill for South Korea Cuts Promised Tax Relief," Wall Street Journal, December 1, 1982, Sec. 2, p. 30e.

Anon., "Seoul: 3-Year Plan Maps GNP Growth of 7.5%, Debt Curb," Wall Street Journal, December 23, 1983, Sec. 2, p. 12e.

Anon., "South Korea Announces Stimulus Package," Wall Street Journal, May 19, 1982, Sec. 2, p. 32e.

Anon., "South Korea Attains Export Goal," Wall Street Journal, December 30, 1983, Sec. 2, p. 12e.

Anon., "South Korea's Exports," Wall Street Journal, January 3, 1983, Sec. 2, p. 38e.

Anon., "South Korea Exports to U. S. Increased 23 Percent During 1st Half of 1981," Wall Street Journal, August 10, 1981, Sec. 2, p. 7e.

Anon., "South Korea Finds Deposits of High-Grade Uranium," Wall Street Journal, May 9, 1980, Sec. 2, p. 45e.

Anon., "South Korea Foreign Exchange," Wall Street Journal, July 7, 1981, Sec. 2, p. 32e.

Anon., "South Korea Gets French Loan to Build Nuclear Power Plants," Wall Street Journal, April 23, 1981, Sec. 2, p. 31e.

Anon., "South Korea Government Must Pay $6 Billion in Debt Principal and Interest this Year," Wall Street Journal, April 21, 1983, Sec. 2, p. 36e.

Anon., "South Korea: High Labor Costs Drive Foreigners Away," Business Week, May 12, 1980.

Anon., "South Korea Intends to Spend $17.8 Billion to Develop Energy Over a 5-Year Period," Wall Street Journal, September 23, 1981, Sec. 2, p. 36e.

Anon., "South Korea Introduces Austere 1984 Budget," Wall Street Journal, September 23, 1983, Sec. 2, p. 34e.

Anon., "South Korea Outlines 5-Year $8 Billion Plan for Industrial Growth," Wall Street Journal, September 8, 1981, Sec. 2, p. 39e.

Anon., "South Korea Projects Balanced 1984 Budget," Wall Street Journal, April 1, 1983, Sec. 2, p. 16e.

Anon., "South Korea to Build a Nuclear Fuel Plant with Foreign Partners," Wall Street Journal, April 30, 1982, Sec. 2, p. 34e.

Anon., "South Korea Trade Deficit Totalled $4.79 Billion in 1980," Wall Street Journal, February 4, 1981, Sec. 2, p. 31e.

Anon., "Steel Concern in Taiwan Plans Major Expansion," Wall Street Journal, August 8, 1983, Sec. 2, p. 20e.

Anon., "Strike Closes New Zealand Refinery," The Oil Daily, December 9, 1982.

Anon., "Taiwanese Financiers Brace for Banking Loss," Journal of Commerce, March 31, 1983.

Anon., "Taiwan: A Push to Build Plants Overseas," Business Week, June 9, 1980.

Anon., "Taiwan Boosts Spending 16% in FY'82 Budget," Wall Street Journal, March 26, 1981, Sec. 2, p. 30e.

Anon., "Taiwan Curbs Activities of Foreign Bankers to Curtail Competition," Wall Street Journal, December 15, 1980, Sec. 2, p. 28e.

Anon., "Taiwan Economic Forecast," Wall Street Journal, February 25, 1983, Sec. 2, p. 30e.

Anon., "Taiwan Lifts its Ban on 594 Imported Items," Wall Street Journal, September 19, 1983, Sec.2, p. 36e.

Anon., "Taiwan May Let Foreigners Buy Stock Again," Wall Street Journal, April 24, 1981, Sec. 2, p. 36e.

Anon., "Taiwan Power Delays Two Nuclear Projects," Wall Street Journal, July 13, 1982, Sec. 2, p. 37e.

Anon., "Taiwan: The Economy Puts a Damper on Energy," Business Week, August 9, 1982.

Anon., "Taiwan's Trade Surplus Up in September From '82," Wall Street Journal, October 12, 1983, Sec. 2, p. 32e.

Anon., "Tantalum-Sources and Supply," World Mining, March 1978.

Anon., "Texas Pacific Thailand, Inc., Commensing Operations," Business Review, November 1983.

Anon., "Thai Inflation Rate," Wall Street Journal, December 13, 1983, Sec. 2, p. 38e.

Anon., "Thai Taxes on Tax Rebates Upset Foreign Firms," Wall Street Journal, June 29, 1983, Sec. 2, p. 38e.

Anon., "Thai's Accept Findings of Lower Gas Reserves at Field Run by Unocal," Wall Street Journal, December 15, 1983, Sec. 2, p. 35e.

Anon., "Thailand," Mining Annual Review, 1983.

Anon., "Thailand: Excellent Growth Record During World Slump Suggests a Bright Future for the Economy and Import Market," Business America, July 11, 1983.

Anon., "Thailand: Ingredients are Present for Rapid Economic Progress; This is an Attractive Destination for Exports, Investments," Business America, November 30, 1981.

Anon., "Thailand Producing Crude Oil," The Journal of Commerce, December 22, 1982.

Anon., "Thailand Reduces Refinery Growth," The Oil Daily, July 20, 1983.

Anon., "Thailand Says Union Oil Agreed to Boost Erawan Field Spending," The Oil Daily, August 25, 1982.

Anon., "Thailand's Trade Deficit," Wall Street Journal, March 6, 1984, Sec. 2, p. 39e.

Anon., "Thailand Will Allow Fewer Tax Waivers on Short-Term Loans," Wall Street Journal, June 23, 1983, Sec. 2, p. 36e.

Anon., "Tin Mining Today - Placer and Lode Mining and Beneficiation," World Mining, February 1977.

Anon., "Two Firms Pay Thai Oil Royalties," The Oil Daily, July 25, 1983.

Anon., "Union to Boost Thai Gas Output," The Oil Daily, July 11, 1983.

Anon., "Venture in Thailand Plans Zinc Smelter Costing $142 Million," Wall Street Journal, October 27, 1981, Sec. 2, p. 36e.

Anon., "What's Going on in World Mining," World Mining, 1973-1984.

Anon., "Word Due on Thailand LNG Project Exports," Oil and Gas Journal, July 26, 1982.

Anon., "World Bank Lends $150 Million to Thailand," Wall Street Journal, March 5, 1982, Sec. 2, p. 34e.

Anon., "Worldwide Survey," World Mining, 1972-1984.

Anon., "Zapata Unit Granted Rights to Search for Oil Off South Korea Coast," Wall Street Journal, June 29, 1981, Sec. 2, p. 24e.

Amaret, Sila-On, "Thai Population Swells as Resources Shrink," Wall Street Journal, October 3, 1983, Sec. 2, p. 31e.

Argall, George O., Jr., "Offshore Tin Dredging in Thailand by Divers, Bucket, and Suction Dredges," World Mining, April 1977.

Armacost, Michael H., "U. S. - Philippines Economic Relations," Forbes, August 1, 1983.

Baker, R. Palmer, Jr., et al., Taxation of Foreign Income by United States and Other Countries, Princeton: Tax Institute of America, 1966.

Baker, Russel, et al., Taxation and Operations Abroad, Princeton: Tax Institute, Incorporated, 1960.

Bauck, Gary, "New Zealand: Long-Range Outlook Bright Despite Present Difficulties," Business America, February 21, 1983.

Bauck, Gary, "New Zealand: U. S. Maintains its Share of Buoyant Import Market," Business America, February 8, 1982.

Bauck, Gary, "New Zealand: Major Projects Offer Best Prospects During Decline," Business America, August 22, 1983.

Bauck, Gary, "New Zealand: U. S. Market Share Increases, Investment Attitude Changes," Business America, July 27, 1981.

Boydell, Michael, "Port Facilities are Being Upgraded to Expand Taiwan's Shipping Role," Journal of Commerce, October 12, 1982.

Brown, Glen F., et al., Geological Reconaissance of the Mineral Deposits of Thailand, Geological Survey Bulletin 984, Washington, D. C.: U. S. Government Printing Office, 1951.

Browning, E. S. and Schiffman, James R., "South Korea Tries to Cut Economic Role of Government, but Bureaucracy Resists," Wall Street Journal, September 1, 1983, Sec. 2, p. 28e.

Buczynske, Richard J., "The Manufacturing Countries Will Register Gains," Business Week, November 21, 1983.

Bunge, Frederica M., South Korea: A Country Study, Washington, D. C.: U. S. Government Printing Office, 1982.

Bunge, Frederica M., Thailand: A Country Study, Washington, D. C.: U. S. Government Printing Office, 1981.

Bureau of Science, Manila, Geology and Mineral Resources of the Philippines, by Warren D. Smith, Manila: Bureau of Printing, 1924.

Chaffee, Frederick H., et al., Area Handbook of the Republic of China, Washington, D. C.: U. S. Government Printing Office, 1969.

Cheah, Cheng-Hye, "South Korea Seeking Loan of $500 Million," Wall Street Journal, September 23, 1983, Sec. 2, p. 34e.

Choo, Tan-Siok and Mukherjee, Delip, "Mineral Wealth Exploration," Focus on Thailand, Bangkok: Kuala Lumpur, November 12, 1983.

Chown, John F., Taxation and Multinational Enterprises, London: Lognman Group Limited, 1974.

Chung, Chong-Shik and Kay, Kwang-Gil, Korea Annual - 1983, Seoul: Yonhap News Agency, July 1983.

Council for International Economic Cooperation and Development, Taiwan Statistical Data Book 1969, Taipei: Bureau of Government Printing, 1969.

Conrad, Robert F., Taxation of Mineral Resources, Lexington: D. C. Heath and Company, 1980.

Daniel, Sheila, "Thailand Counting on Offshore Gas Finds to Boost Economy, Ease Trade Deficits," The Oil Daily, May 18, 1982.

Department of Mineral Resources, "The Plan to Exploit the Mineral Resources: The End of Our Debt or the End of Us?" Bangkok: PATINYA, July 11, 1983.

Department of Statistics, Wellington, New Zealand Official Yearbook 1983, Wellington: E. V. Paul, Government Printing and Binding, September 1983.

Directorate-General of Budget, Accounting, and Statistics, Republic of China, Statistical Yearbook of the Republic of China 1976, Taipei: Bureau of Government Printing, 1977.

Disine, A. F., "The Philippines," Mining Annual Review, 1983.

Droker, Linda, "Thailand: Sound Economy Poised to Participate in any Recovery," Business America, February 21, 1983.

Drummond, Jim, "Exploration Atmosphere Improves in Australia and New Zealand," The Oil Daily, September 9, 1981.

Drummond, Jim, "Gasoline from Natural Gas Plan Pursued," The Oil Daily, March 3, 1983.

Drummond, Jim, "New Zealand's Drilling Boom to Defy Weak World Oil Market," The Oil Daily, March 9, 1983.

Drummond, Jim, "New Zealand is Committed to Gas-to-Gasoline Project," The Oil Daily, April 7, 1982.

Drummond, Jim, "New Zealand Leases Attract Many Firms, The Oil Daily, December 24, 1981.

Duvall, Daniel and Lamb, Deborah, "Korea: Economy Set for Recovery; U. S. Becomes Top Supplier," Business America, February 21, 1983.

Europa Publications Limited, "China (Taiwan)," The Europa Yearbook 1983, A World Survey, London: Europa Publications, 1983.

Government Information Office, Republic of China, Republic of China: A Reference Book, Taipei: United Pacific International, Inc., 1983.

Grace, D. A., et al., "Exploration and Development in 1982," World Mining, August 1983.

Guerrero, Perfecto K. and Salita, Domingo C., "Natural Resource - Impact of Exploitation on Environment in the Philippines," The Philippines Geographical Journal, October 1980.

Hahn-Choon Lee, "Korea: Land of Surprising Export Growth," American Import-Export Management, December 1982.

Ho, Chun-Sun and Lee Chin-Nan, Economic Minerals of Taiwan, Taipei: Geological Survey of Taiwan, 1963.

Holden, Dennis W., "Korean Debt Picture Appears to be Sound," United States Banker, October 1983.

Hough, G. Vernon, "New Zealand: Optimistic Prospects for Exploration," Petroleum Economist, January 1984.

Jones, Arthur, "Where Adam Smith Meets Confucius," Forbes, December 19, 1982.

Kuala Lumpur and London, "Tin: Swapping Cartels," Economist, June 26, 1982.

Lachica, Edwardo, "South Korea Lowers its Import Barriers in Effort to Appease U. S. Administration," Wall Street Journal, January 3, 1984, Sec. 2, p. 34e.

Lehner, Urban C., "Koreans Finding a World of Difference Between Carter and Reagan Policies," Wall Street Journal, December 15, 1981, Sec. 2, p. 34e.

Lorenz, Keith, "Thai Rails to Compete with Highway System," The Journal of Commerce, September 21, 1981.

Lorenz, Keith, "Thailand Launches Vital Five-Year Plan," The Journal of Commerce, July 27, 1982.

Lorenz, Keith, "Thailand Seeks Industrial Projects to Offset Drop in Foreign Investments," The Journal of Commerce, July 2, 1981.

Magnuson, Robert and Browning, E. S., "Japanese Bank Sets 'Quiet' Taiwan Loan," Wall Street Journal, April 13, 1983, Sec. 2, p. 30e.

Mantrop, Stanley, "Thai's Open Campaign for More U. S. Investors," The Journal of Commerce, May 17, 1983.

McKinnon, Robert, "New Zealand Offers a Third Option," The Director, July 1981.

McLauchlin, Gordon, "New Zealand Feeling Pressed for Access to Foreign Markets," The Journal of Commerce, April 13, 1982.

McLauchlin, Gordon, "New Zealanders Argue Over National Debt," The Journal of Commerce, December 23, 1982.

Metzler, John J., "New Mill Sharply Boosts Taiwan's Steel Output," The Journal of Commerce, March 5, 1982.

Ministry of Communications, "Faster Connection with the Eastern Seaboard," Business in Thailand, July 1983.

Ministry of Culture and Information, Korean Overseas Information Service, A Handbook of Korea, 4th Edition, Seoul: Samhwa Printing Co., Ltd., January 1982.

Norman, Peter, Shao, Maria, and Hye, Cheah-Cheng, "Taiwan Body Backs Offshore Banking," Wall Street Journal, November 30, 1983, Sec. 2, p. 32e.

Mufson, Steve, "Mobil Proceeds With Gas Plant in NZ," Wall Street Journal, December 29, 1981, Sec. 2, p. 4e.

National Census and Statistics Office, Foreign Trade Statistics of the Philippines, 1981, 1982.

National Energy Administration, Ministry of Science, Technology, and Energy, Thailand Energy Situation, 1982, Bangkok: Bureau of Government Printing, 1983.

New Zealand Mines Department, The Mineral Deposits of New Zealand, Wellington: E. V. Paul, Government Printer.

Paine, George, "Philippines Export Level Bolstered by Preference for U. S. Goods," Business America, August 9, 1981.

Parker, Marcia A., "Action in New Zealand," Oil and Gas Journal, November 15, 1982.

Parker, Marcia A., "Drilling Program Due Off New Zealand," Oil and Gas Journal, October 17, 1983.

Parker, Marcia A. "South Korea Stepping Up Offshore Exploration," Oil and Gas Journal, September 26, 1983.

Patrick, Betty M., "Taiwan's Development into Industrial Economy Creates Demand for Advanced Capital Equipment," Business America, January 11, 1982.

Patterson, David S., "South Korea Faces Tough Choices on Policy," The Journal of Commerce, January 18, 1984.

Philippines Bureau of Commerce and Industry, Concentration in Philippine Manufacturing, 1960-1970.

Philippines Bureau of Commerce and Industry, Philippines Islands Statistical Bulletin, 1969.

Pine, Art, "Taiwan Seeks Move to High Technology; Plan Could Pose Threat to U. S. and Japan," Wall Street Journal, January 20, 1983, Sec. 2, p. 53e.

Polahan, Prakong, Thailand Department of Mineral Resources, "Shell's Oil Development, ESSO's Gas Finds - Both Onshore - Highlight Action in Thailand," Oil and Gas Journal, May 16, 1983.

Pura, Rapheal, "Asian Rubber Producers Apparently Fail to Reach Accord on Plan to Curb Supplies," Wall Street Journal, September 10, 1982, Sec. 2, p. 42e.

Republic of the Philippines, Department of Agriculture and Natural Resources, Bureau of Mines, Manila, Information Circular No. 16, Copper in the Philippines, June 1983.

Rosell, Dominado Z., "Suggested Research and Development of the Water Resources in the Philippines," The Philippine Geographical Journal, October 1982.

Scholla, Paul F., et al., Tin Deposits in Thailand, Bangkok: Paul F. Scholla and Associates, July 1977.

Scholla, Paul F., et al., Tungsten in Thailand, Bangkok: Paul F. Scholla and Associates, July 1977.

Shao, Maria, "Newly Industrialized Taiwan's Pollution Begins to Reach Worrisome Proportions," Wall Street Journal, July 15, 1983, Sec. 2, p. 30e.

Shapiro, Don, "Government Scales Down Energy Plans," The Journal of Commerce, October 12, 1982.

Shapiro, Don, "Nation's Trade Hits $43 Billion in 1981, Ranks 19th in World," The Journal of Commerce, October 12, 1982.

Shin, Ho-Chul, "Korean Textiles Today: Big Plans, Big Problems," Textile World, April 1982.

Smith, Lee, "Korea's Challenge to Japan," Fortune, February 6, 1984.

Swansan, Donald, "A Close Look at the Philippines," Forbes, August 18, 1980.

Thai Board of Investment, "Thailand: An Open Door for Investors," Nation's Business, September 1983.

Thorpe, Norman, "South Korea's Economic Program Reduces Expansion of Several Major Industries," Wall Street Journal, July 24, 1981, Sec. 2, p. 24e.

Truell, Peter, "South Korea Seeking $500 Million, Thailand Asks for $85 Million Loan," Wall Street Journal, March 6, 1984, Sec. 2, p. 38e.

U. S. Department of the Interior, Bureau of Mines, "The Mineral Industry of Taiwan," by Edmond Chin, Minerals Yearbook, Washington, D. C.: U. S. Government Printing Office, 1981 Reprint.

U. S. Department of the Interior, Bureau of Mines, "The Mineral Industry of Taiwan," by Edmond Chin, Minerals Yearbook, Washington, D. C.: U. S. Government Printing Office, 1982 Reprint.

U. S. Department of the Interior, Bureau of Mines, Minerals Yearbook, Washington, D. C.: U. S. Government Printing Office, 1960-1982.

U. S. Department of the Interior, Bureau of Mines, "The Mineral Industry of the Philippines," by John C. Wu, Minerals Yearbook, Washington, D. C.: U. S. Government Printing Office, 1981-1982.

U. S. Department of the Interior, Bureau of Mines, "The Mineral Industry of Thailand," by Gordon L. Kinney, Minerals Yearbook, Washington, D. C.: U. S. Government Printing Office, 1960-1982.

U. S. Department of the Interior, Bureau of Mines, "The Mineral Industry of New Zealand," by Charles L. Kimbell, Minerals Yearbook, Washington, D. C.: U. S. Government Printing Office, 1960-1982.

U. S. Department of the Interior, Bureau of Mines, "The Mineral Industry of the Republic of Korea," by Edmond Chin, Minerals Yearbook, Washington, D. C.: U. S. Government Printing Office, 1960-1982.

U. S. Department of State, et al., Countries of the World and Their Leaders Handbook 1984, Volume 2, Detroit: Gale Research Company, 1984.

Vreeland, Nena, et al., Area Handbook for the Philippines, 2d Edition, Washington, D. C.: U. S. Government Printing Office, 1975.

Vreeland, Nena, et al., Area Handbook for the Philippines, 3rd Edition, Washington, D. C.: U. S. Government Printing Office, 1982.

Vreeland, Nena, et al., Area Handbook of South Korea, Washington, D. C.: U. S. Government Printing Office, 1975.

Vreeland, Nena, et al., Area Handbook of South Korea, 2d Edition, Washington, D. C.: U. S. Government Printing Office, 1982.

Wellington and London, "Is it Synful for Bankers to Think Big in New Zealand?" The Economist, June 12, 1982.

Williams, Nick and Ronny, Mary, "New Zealand: A World All its Own," Publishers Weekly, July 3, 1981.

Windle, David H., "New Zealand: Economy Offers U. S. Long-Term Opportunities," Business America, August 9, 1982.

Ying, Diane, "Taiwan Firms Turn to Foreign Plants, Especially in U. S., to Cope with Problems," Wall Street Journal, August 5, 1980, Sec. 2, p. 31e.

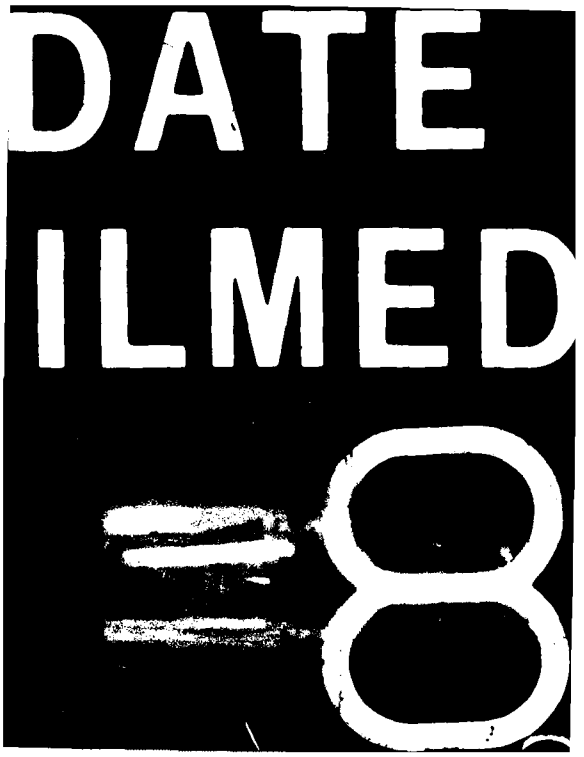
Ying, Diane, "Trading Jungle in Taiwan is Chasing Potential Investors Away from Stocks," Wall Street Journal, November 13, 1980, Sec. 2, p. 39e.

# VITA

Paul Charles Spinler was born in Rush City, Minnesota, on June 27, 1953, the son of Clarence and Ann Spinler. He spent his pre-adult years working on his parents' dairy farm in Brook Park, Minnesota. After graduating from Hinckley High School, in Hinckley, Minnesota, he attended Saint John's University, Collegeville, Minnesota, where he obtained a Bachelor of Arts Degree in Mathematics in 1975. On May 25, 1975, he received an officer's commission in the United States Army as a Petroleum Logistics Officer in the Quartermaster Corps. While serving as a platoon leader, operations officer, and executive officer in a petroleum supply company, he was stationed in Virginia, Alabama, Indianna, South Carolina, and Texas. As a division petoleum supply manager, he was stationed in Korea, Kentucky, Louisianna, and Kansas. After attending night school for two years, he received a Master of Science Degree in Systems Management from the University of Southern California in May 1982. In September 1983, he entered the Graduate School of the University of Texas at Austin, in the Energy and Mineral Resource Program. Upon graduation, he will be assigned as the Battalion Plans and Operations Officer in the 260th Quartermaster Battalion, Hunter Army Airfield, Savannah, Georgia.

Permanent address: Rural Route 2
Brook Park, Minnesota 55007

This thesis was typed by the author.


DATE
ILMED
8